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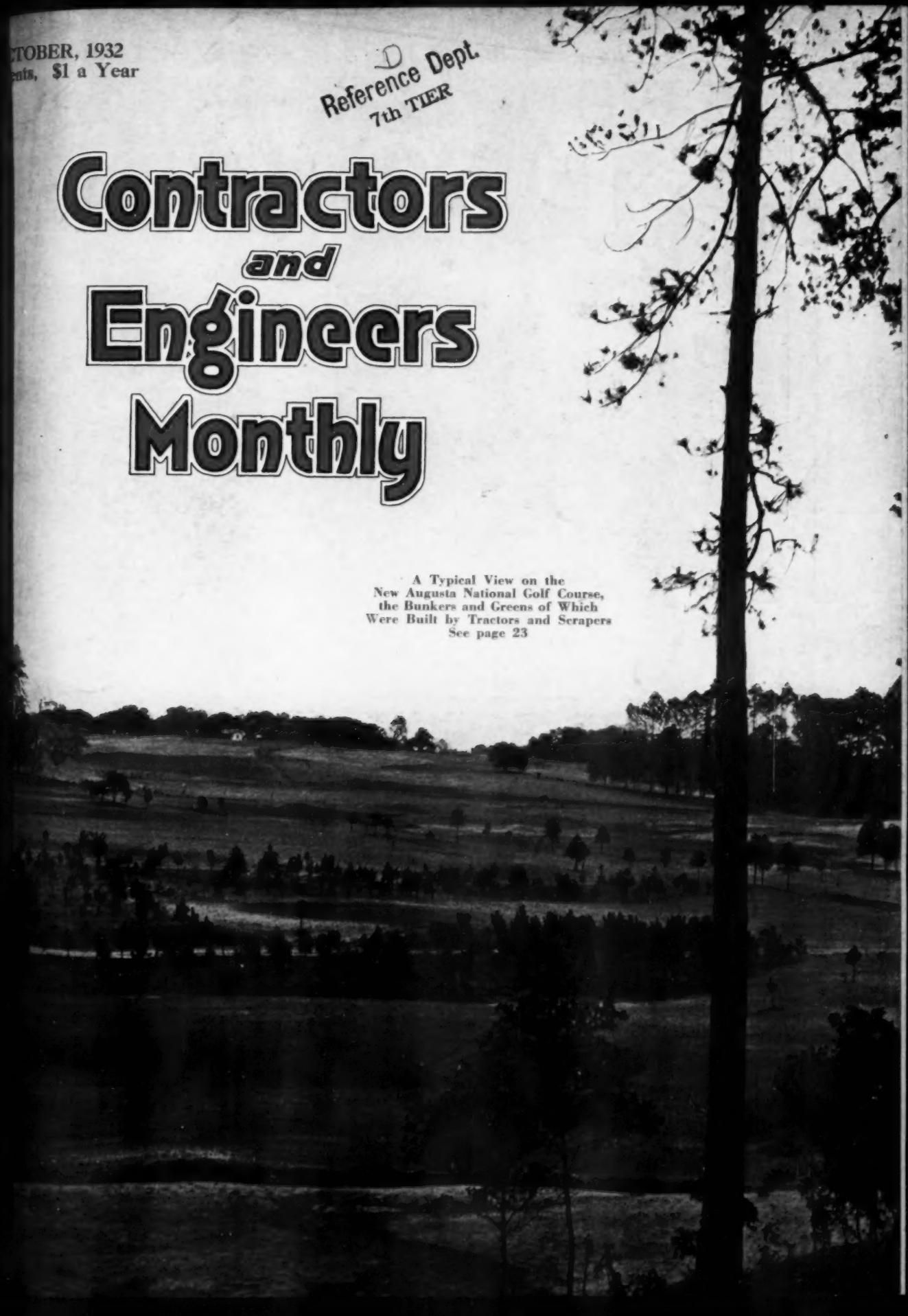
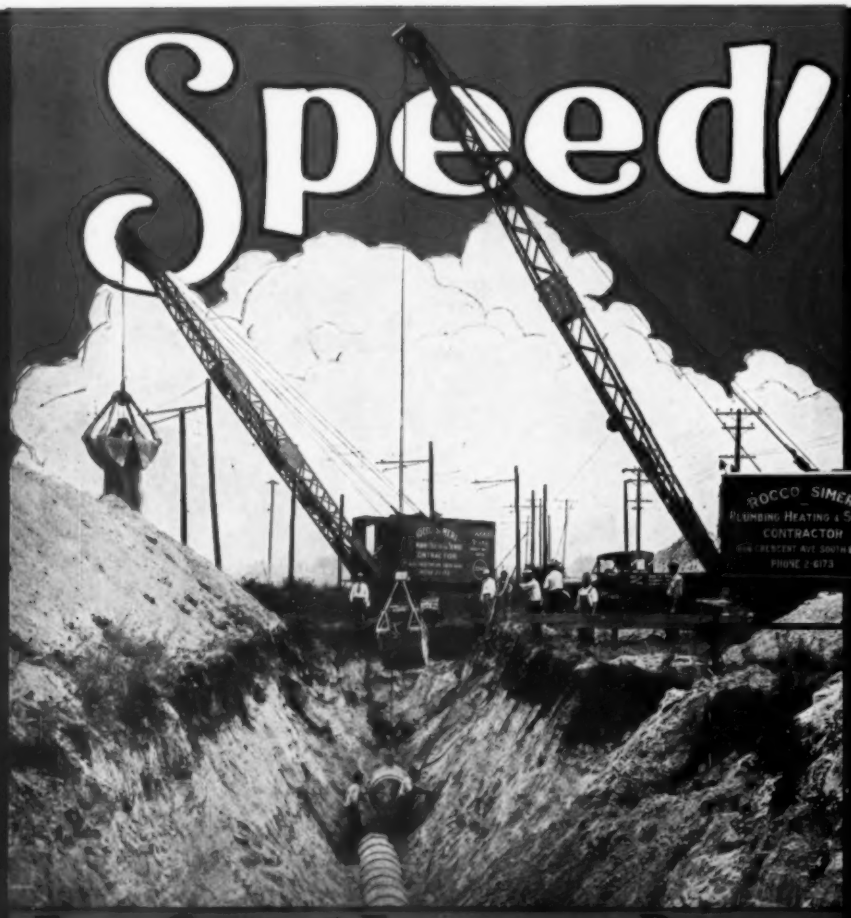


A Typical View on the New Augusta National Golf Course, the Bunkers and Greens of Which Were Built by Tractors and Scrapers
See page 23

Speed!



3/4 TO 6 YARDS
COMMANDER
CONQUEROR
VICTOR
RAILROAD
GASOLINE STEAM
ELECTRIC
DIESEL

Two OSGOODS of 1½ and 1¼ yds. capacity trenching and laying sewer pipe on the Bendix Aviation Development at South Bend, preparing the way for new factories and homes. These OSGOODS are owned by Rocco Simeri, leading excavating contractor of South Bend, Indiana, who has handled practically all of the excavation necessary for the tremendous Bendix expansion program. "To get work done quickly, economically, and efficiently the OSGOOD is the best help in the world," Mr. Simeri says.

Easy Control·Enormous Power Unite for maximum SPEED

OSGOODS are fast workers and big profit earners! As a shovel, dragline, backhoe, crane or clamshell OSGOOD is years ahead of the average digging tool. It bites deep and actually eats up yardage. Quick swinging and hoisting—absolute control of every motion—economy in operation and maintenance earn the respect of the operator and the confidence of the owner. Reserve power and strength at every vital point assures continuous speedy and PROFITABLE SERVICE.

Combine easy operation and tremendous power and your result is digging speed. OSGOODS are equipped with husky six cylinder engines—simply rigged and designed to put every ounce of power right down in the dipper teeth through the patented wire rope crowd and the powerful hoist—and every digging operation is controlled from the operator's seat.

THE OSGOOD CO.
MARION OHIO

During October we hope you will remember to mention CONTRACTORS AND ENGINEERS MONTHLY

Building New Levee

by the

Rational Method

Drainage of Pits and Hauling Methods Coordinated by the Valley Construction Co. at Vidalia, La.

The Spotter

HIGH water spells disaster to the levee contractor. First it completely prevents getting his machines to the site of his contract and then it means a long delay waiting for the pits to dry out before he can put his draglines and wagons to work. Of course, pumping helps to get the water out quickly where there are old pits to be extended but the opening of new pits in territory where the water level is still high is another story. It remained for the Valley Construction Co. to develop a truly rational method of opening pits and draining them and moving the dirt with the least number of handlings with both dragline and wagons. Paradoxical as it may seem, the dirt at the far side of the pits from the levee was moved first to the side of the levee section farthest away from the pits, but that meant a saving in the end. Read the story of how it was done.

THE CONTRACT AT VIDALIA, LA.

Although the contractor has used this method of handling dirt on many other contracts in the last few years we will limit the description to the work during the summer of 1932 on a contract involving the handling of about 3,000,000 yards of dirt on 6 miles of new levee south of Vidalia, La. The area was grubbed and cleared last fall and the work continued by subcontract this year immediately ahead of the contractor. The subcontractor on clearing and grubbing removed the stumps and brush from an area of 260 acres. He used three stump pullers for the smaller stumps and others were blown out. A drill rigged up on a Fordson tractor bored the holes for the dynamite, making the process of blowing them out quite simple. A dozen or so stumps were drilled and loaded and then shot at one time with a great array of roots and splintered stumps littering the skyline during the shot. Because of continued high water, work on the moving of dirt was not started until early in May, 1932.

The equipment used consisted of a Monighan walking dragline with a 170-foot boom and a 9-yard Williams bucket which could handle dirt a distance of 350 feet; a Thew-Lorain dragline with a 40-foot boom and a 2-yard Page bucket loading to four 8-yard Euclid crawler wagons, two 12-yard Euclid wagons and two 8-yard LaPlant-Choate crawler wagons. These crawler wagons were pulled by seven Caterpillar Sixties and there was an extra Sixty with a Euclid bulldozer for maintaining the runways for the crawler wagons and for dressing the final slopes of the levee. The contractor used a driver for each tractor but only two winders for the entire fleet, thus saving considerably in his labor as the winders do not have enough to do on a 775-foot haul if there is a winder for each wagon. There were three men on the dump, a spotter and two helpers. There was an operator for the dragline but no oiler as the operator did that work himself.

On the Monighan, which was operated by a Fairbanks-Morse 350-horsepower diesel engine running at 300 rpm, there were an operator and an engineer. In addition to this operating crew there were the levee men, a spotter and two helpers. The hauling was run in two 10-hour shifts requiring lighting of the dump by a 1,500-watt Kohler plant in a small house on skids so that it could be moved readily from one point to another as the work progressed. The Monighan and the Lorain were both equipped with 1,500-watt Kohler electric plants also and the Monighan had a 5,000-watt belt-driven generator running off the main engine but the Kohler was used as a standby in case the diesel plant developed trouble, making it impossible to generate electricity for night repairs on the machine. Each tractor carried one headlight and one of the Kohler plants was used in the day to provide power to operate the electric drills of the machine shop that was mounted on skids and moved with the work. There were an extra tractor and wagon so that the greasing of the machines which was done daily could proceed without delaying the hauling of the dirt, and could be done all through the day.

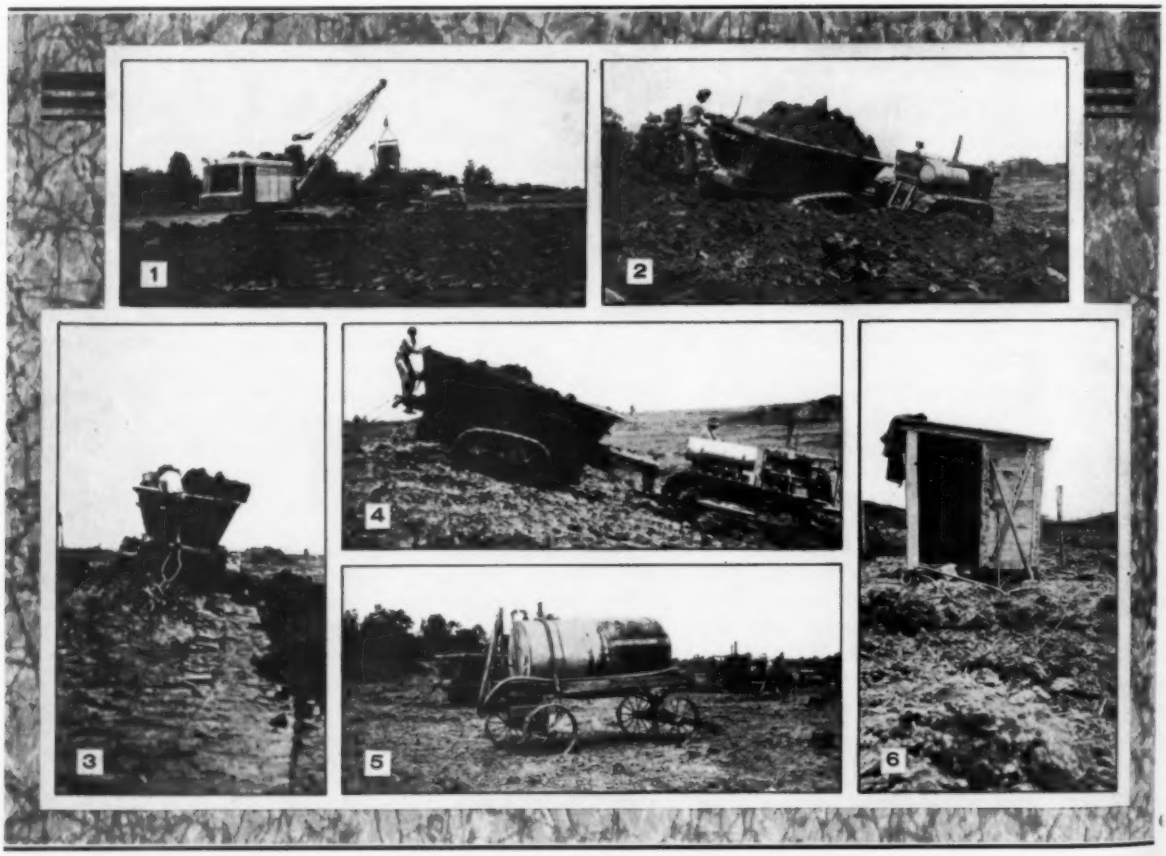
While running two 10-hour shifts on the wagons and dragline, the Monighan ran three 8-hour shifts as follows: from 12 noon to 8 P.M. topping off; from 8 P.M. to 6 A.M. roughing in, and from 6 A.M. to noon roughing in. There were three men on the Monighan dump dressing the slope. A Euclid 4-disc plow was used on all the work for breaking ground ahead of the placing of any dirt. This was pulled by a Caterpillar Sixty. The wagons moved 3,500 yards of dirt in the daily double shift and the Monighan moved 5,500 yards in its three 8-hour shifts.

There was a Koehring 1-yard dragline for digging the muck ditch ahead of the building of the new levee, which is sometimes called the exploration ditch. The Koehring was not used for dressing as the three men on the wagon dump handled that work sufficiently well to eliminate the need of machine dressing.

Other miscellaneous equipment on the job included three 500-gallon gasoline tanks, two of which were on skids and the third on four steel wheels. A 500-gallon water tank on skids was used to furnish water for the Monighan and the tractors.

NOW FOR THE METHOD

A glance at the diagram will show the general layout of the work and the dimensions of the levee, pits and various cuts. The first operation was to cut a drainage trench at the outside edge of A with the Lorain dragline to the maximum depth of the pit, or about 19



MACHINES AND ACCESSORIES USED IN LEVEE BUILDING NEAR VIDALIA, LA.

1. The crawler dragline with a 40-foot boom and 2-yard bucket loading one of the crawler wagon outfits. 2. Up on top of the new levee even the crawler wagons sometimes sank into the loose earth. 3. Preparing to dump one of the big wagons on the crest of the levee. 4. The winder closing the bottom-dump doors as the crawler wagon speeds down the slope of the new levee. 4. A 500-gallon gas tank which could be moved anywhere on the job. 6. A portable electric plant, protected from the weather by a house on skids, furnished light for night work.

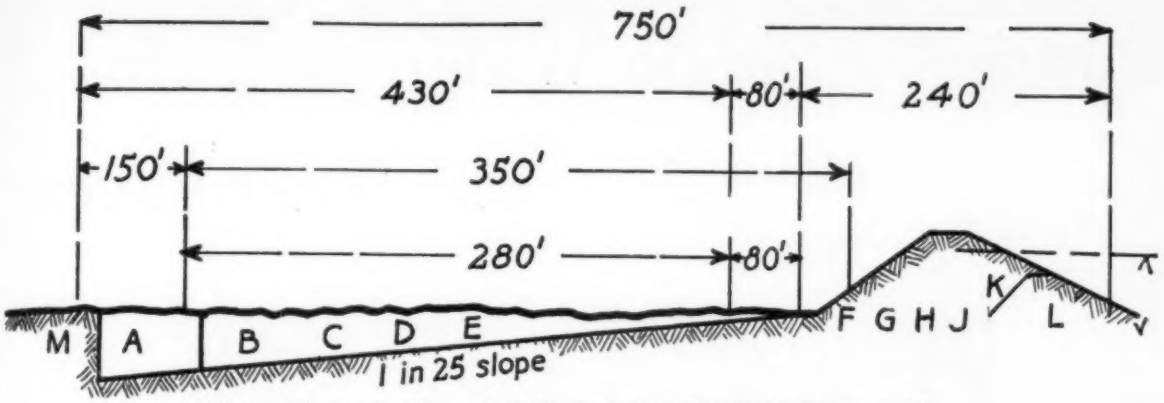


Diagram Showing the Movement of Dirt in the Rational Method of Levee Building

feet deep. This immediately lowers the ground water in the entire area, making the operation of the crawler wagons easier. At the lower end of the trench a Fairbanks-Morse 5,000-gpm, 12-inch centrifugal pump with a 6-cylinder Waukesha motor was installed to take out the water and deliver it to another trench cut by the Koehring and leading to a nearby creek.

Following the completion of the drainage trench in any one section the Lorain dragline went in and excavated a pit about 140 feet in width, and to a depth depending on the amount of dirt needed in the levee at that point for the section marked L. This dirt was taken from A and the lift kept to a minimum. The dirt was loaded to the crawler wagons which hauled it to L and spotted it to build the first lift of the levee in miniature. This required a maximum haul of 775 feet which is an economical operation for the crawler wagons.

After this the Monighan was moved in, placed at the midsection of the remaining width of the pit and loaded successively from B to F, C to G, D to H, and E to K. If this dirt was for any reason not enough to top out the levee section immediately behind the pit and there was any part such as K which needed dirt, the Monighan was moved out into the pit a bit and moved dirt from M to a point close to section F from which it was rehandled to top out. This was not necessary as regular procedure but was the method used when not enough dirt was secured from the pit. It is regular levee practice not to move dirt to the levee section, unless absolutely necessary, from any point not immediately in front of the section being built. This has its economic justification for as soon as the next section of pit is robbed of dirt to make up the preceding levee section the haul runs up and that overhaul must be continued all along the line. It is cheaper to haul a short additional distance at right angles to the line of the levee than to haul on the diagonal anyway because the distance is shorter.

PERSONNEL

This 3,000,000-yard item of levee construction was awarded to the Valley Construction Co. of Newellton, La., at 15.85 cents. The work was in charge of the two partners, D. B. Gore, President, and David D. Coleman, Secretary-Treasurer. The work was done in the New Orleans District, U. S. Engineer Corps, Col. J. N. Hodges, District Engineer, under the direction of the Natchez, Miss., Area Office, with D. L. White as Area Engineer.

A Dredge for Unusual Operation in Mexico

AN unusual engineering problem has been solved in the construction of a dredge for the widening and deepening of the Grand Canal of the Valley of Mexico and which is being built for the Mexican Federal Government. The Grand Canal is about 30 miles long beginning as a sewer outlet where it is about 25 feet deep and ending in a tunnel which is about 90 feet deep. It is to be of trapezoidal section with about 12 feet depth of water, the width at the water surface being about 26 feet and at the bottom about 16 feet.

Because of the narrow width of the Canal, it will not be possible to operate the dredge in the customary way, that is by swinging it about one of the stern spuds. Instead, the cutter machinery has been designed to swing independently of the hull, while the hull will be held stationary by means of two side spuds and one rear spud. This rear spud will also be used as a kicking spud for advancing the dredge forward in the cut. With this arrangement of the cutter machinery, it will be possible to make cuts 14 feet deep, 30 feet wide at the surface and about 24 feet wide at the bottom.

The dredge hull is to be of steel approximately 18 feet wide, 76 feet long and 6 feet deep. It will be operated by a 590-horsepower diesel engine which will drive a 12-inch Morris special heavy-duty dredging pump and a 75-kw generator. This generator will supply current for operating the auxiliaries, including the cutter, the hoist, the service pump, etc. The dredge will be suitable for handling sand, silt, clay, etc., and will be capable of delivering through 1,600 feet of pipe line against a lift of 40 feet or through 700 feet of pipe line against a lift of 90 feet. The dredge was designed and the hull, dredging pump, service pumps, cutter and accessories are all being furnished by the Morris Machine Works, Baldwinsville, New York.

Tower Machine and Crawler Wagons Unite in Levee Construction

The construction of 7 miles of new levee near Lake Village, Ark., involving the handling of 2,300,000 yards of dirt by crawler wagons for base and false berm and an electric tower machine for building the levee will be described in the November issue of CONTRACTORS AND ENGINEERS MONTHLY.

Pouring *a* Single Widening Strip *with* Two Pavers

A Unique Method of Handling Concrete for Lip Curb

ROUTE 422, a Federal highway, running from Cleveland toward Youngstown and on to Pittsburgh, Pa., is an important thoroughfare and the 16-foot concrete road was not sufficient to carry the traffic safely. It had also shown signs of disintegration. To remedy this the Ohio Department of Highways awarded a contract early in 1931 for the widening of the road with 12½ feet of concrete and the covering of the old concrete with bituminous concrete. The contractor handled the work in a very interesting manner and made very good progress when not bothered with equipment problems. A 10½-foot strip of concrete was laid on the south side of the old concrete 2⅝ inches higher than the old slab and with a space of 2 feet between the new and old slabs during the initial pouring. After some length of the new concrete had been poured with dowels run through the forms, the paver went back and poured the 2-foot strip at the elevation of the old slab. When pouring the 2-foot strip the concrete was dumped on the old slab and raked and shoveled into the space between and hand floated, which was sufficient as it was later covered with bituminous concrete.

Rough Grading

One of the four subcontractors on this job handled the rough grading. The other jobs subcontracted were culverts and bridges, sewer tile drains, and batch hauling. The rough grading included the removal of about 1½ miles of old concrete pavement where the waves were taken out of the grade. The concrete was broken with a "skull cracker" handled by a crane and the material stockpiled along the shoulders for reclaiming for aggregate by the state. A Lima 101 1-yard shovel loaded the excavation and the broken concrete to a fleet of three or four trucks. As there were no fills on the regrading all the spoil was wasted. The shoulders were shaped up with the Caterpillar Sixty pulling a 12-ton Galion grader.

Preparing the Fine Grade

The shallow fills required in the fine grade were made with an RC Ground Hog rotary scraper and pulled by a Caterpillar Thirty. The shallow cuts on the grade were made by a Galion 10-foot power maintainer. Two rollers were used on the grade to compact the shallow fills and the sections where cuts were made. These were a 10-ton Buffalo-Springfield gas roller ahead of the forms and a 5-ton Galion between the forms. Only about six men were used in the hand work on fine grade and these were used mostly behind the Lakewood subgrader which was cut down from a full width 20-foot machine. The form trenches were cut with the blade and trimmed by hand.

One form setter with three helpers on each side set the 9-inch and 10-inch Heltzel forms. The latter were 1 inch too high so the trench was cut a corresponding amount deeper to make up for the added depth and still have the forms at grade. The great length of the work requiring two sets of forms for a 10½-foot slab led the

Clements-Orr Company Handled Widening in a Novel Manner on 6.754-Mile Project Between Chagrin Falls and Auburn Corners, Ohio

contractor to use the higher forms that he had on hand rather than buy others for this work.

One man ahead of the paver oiled the forms, sprinkled the grade, watched the paver hose, and pulled the dirt away from the forms as the planer cut it and the fine grade crew may have left small patches. A man handled the steel which included the setting of the steel expansion joints and the 4-foot dowels of ½-inch deformed bars which were run through the forms at approximately 4-foot intervals. The marginal dowel or bar was ¾-inch diameter, shop painted with red lead and 42 feet long and was set 6 inches from the inner form and 6 inches from the base. No dowel was set on the outer side away from the old slab.

Expansion joints 1 inch thick were set every 120 feet using full width Carey Elastite especially cut for this job. Three smooth ¾-inch dowels 4 feet long were run through the expansion joints with sleeves on the side near the new concrete. The joints were set with a plate running the full depth of the joint and a cap at the top.

Handling the Pavers

During one part of the job but one paver was used and that was run down the old slab which was also used by the batch trucks and by traffic which was not detoured. One paver was able to pour from 800 to 1,400 feet of slab per two 7-hour shifts. When the second paver was used the two were used facing so that the buckets were together and thus double the length of slab could be poured with one set up without moving the pavers. With two pavers the daily run for the same length of time was greatly increased. A MultiFoote and a Rex paver were used and the labor organization for the grade and concreting was the same for one and two pavers with the addition of the second paver operator and one or two other laborers.

The organization described will be for one paver for the sake of simplicity. One man dumped the trucks and also took the batch tickets from the drivers and deposited them in a box close at hand. The drivers were paid on the basis of the tickets in the box at the end of the day. The drivers received the tickets from the batch man and carried them to the grade. If any were lost it was the driver's fault and that batch was not paid for. Three and four-batch trucks were used and they turned onto the shoulder from the old slab.

Rakes for Puddlers

One would suppose that "puddler" and "shovel" were always to be found together in articles on road construction where concrete is used but here is the exception that proves that famous old rule that has been proved and disproved for 1931 years. When the present superintendent started his two husky puddlers to work a year ago he told them that they could do better work more quickly with rakes instead of shovels. Believe it or not, the puddlers stuck to the shovels, but Mr. Superintendent took the shovels away and presented them with the rakes again. Again they found some shovels somewhere, they are fairly common on road jobs, and away went the rakes. They were then told once and for all that shovels were tabooed. Now, a whole carload of assorted shovels dumped down on the grade ahead of the puddlers could not divorce these particular puddlers from their rakes.

These are not common ordinary rakes but long tined rakes with short shanks. The tines reach down into the concrete, making pulling easy and instead of picking up the particular bit of grout that happens to be on top or the very dry concrete in another section they mix as they rake, not unlike a famous advertising slogan about vacuum cleaners. The shanks were about 9 inches long on either side of the handle and the tines about 2 inches long.

The puddlers were followed up by the Ord finisher which, like the subgrader, had been shortened to fit the odd width grade. There was an operator for the machine and two spaders working with it with divided duties. The operator ran the machine and watched the right hand side of the slab to see there was no surplus of concrete that would run off into the space between the new and old slabs. The spader on the right side spaded against the forms on that side, carried back concrete to the finishers to fill low spots, watched the steel in the forms to see that it was straight and cleaned the old pavement of the drip from the mixer. The left hand spader watched the strike-off to prevent spilling on his side, shoveled to the strike-off if the roll was low and spaded against the forms on the left side.

Hand Finishing

There were two finishers, one of whom straight-edged the slab while the other used a long handled float and had charge of the work on the lip curb when that was being installed. The straight-edge was a special one made by the contractor and consisted of a 2 x 4 cut to 1¾ inches at the two edges and planed several times a day as required to keep it in condition. Behind the finishers there were two joint men who removed the caps from the expansion joints which were installed every 120 feet and who edged the pavement. They also placed the transverse dummy joints every 40 feet by driving in a steel strip with a sledge after the slab was finished and then refinished over it. They went back at the proper time and pulled the strips and edged the joints for pouring later by another outfit.

At night three men pulled the pins and forms, using oil lanterns for illumination. The forms were hauled ahead before ten in the morning by the utility truck.

CURING

The slab was covered with hay and sprinkled by three men. Only two men were required for the spreading of the hay in the morning after the burlap had been removed and then they went forward and helped clear the concrete from the forms so that they could be pulled easily by the night men. The hay was sprinkled for seven days.

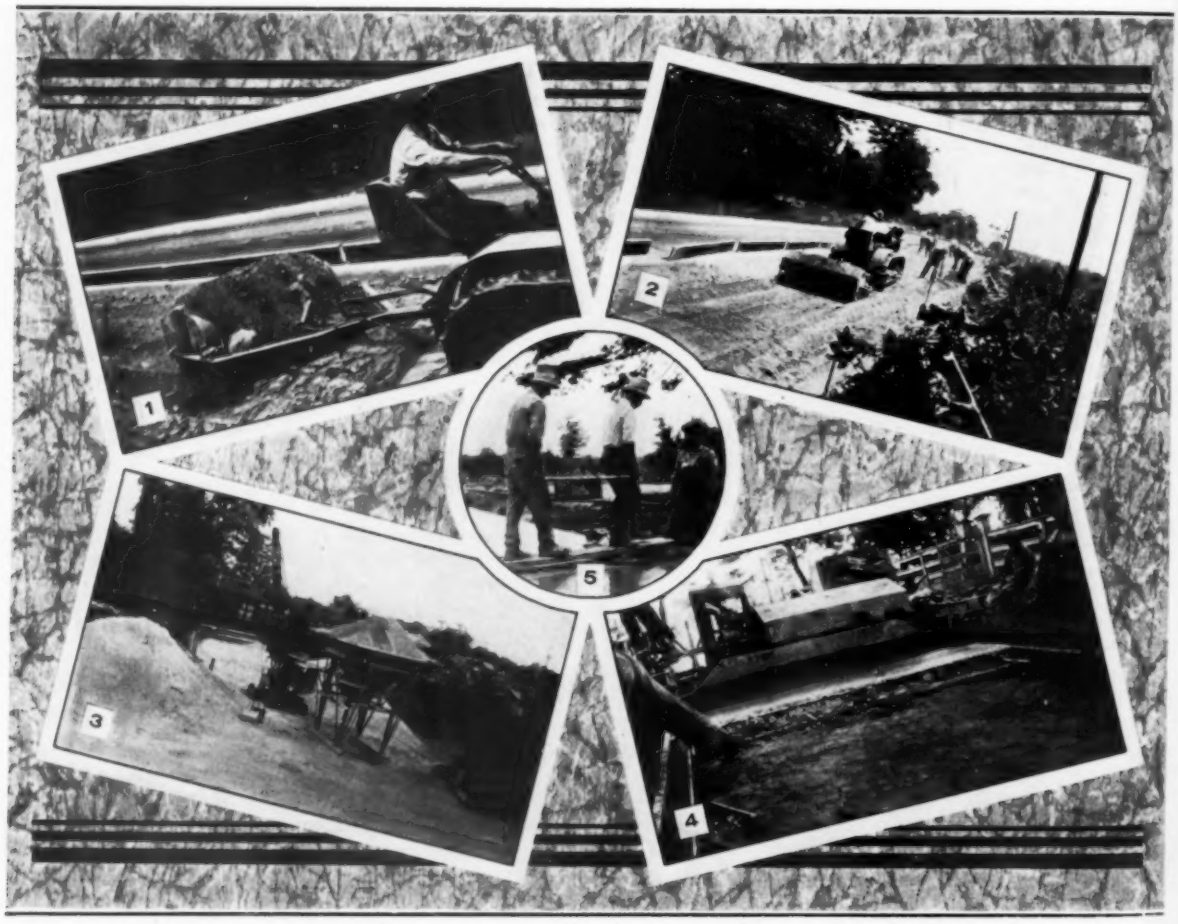
WATER LINES AND PUMP

At the start of the job the stock of 2-inch pipe for the water line was short and so it was moved ahead each night by two men. After the additional pipe arrived there was no such constant moving of pipe. With a daily movement forward of 1,400 feet by the paver it gets rather far from its source of supply with speed. Taps for the paver hose were set every 250 feet and when the paver had passed they were removed and spigots set for the sprinkler hose. The paver carried 150 feet of 1½-inch hose. A Barnes triplex high pressure road pump supplied the water from streams along the right of way.

LAYING THE LIP CURB

On the outside of the new slab a lip curb was built on the grades. Heltzel 4-inch curb forms were used tied to the road forms with slotted buttons with wedges to set them tight. Two men with a steel box of about 1 cubic foot capacity carried the concrete back from a batch dumped on the old slab. Instead of shoveling the concrete from the pit into mortar boxes or wheelbarrows the contractor chose this method as he was able to select a better batch for the curb builders. Wet concrete does not work well in building curb as it is always made on a grade and any excess water that is worked out by the hand floats of the finishers will run down the grade and leave a noticeable streak on the slab. The carrying box had two pipe handles which ran through hooks on the box so that the men could carry it with

(*Continued on page 26*)



GRADING AND CONCRETING OPERATIONS ON AN OHIO 6-MILE WIDENING JOB

1. A Thirty tractor with a rotary scraper pulled out the excess dirt on the preliminary fine grade operations. 2. Hand labor trimmed the grade and form trenches after the tractor and scraper assisted by a blade maintainer had shaped up the grade. 3. Stockpiles were formed by dumping from a material yard trestle, the limestone and sand then being loaded to the weighing batcher plant by a crane and clamshell. 4. A bulkhead forming a construction joint at the end of a day's work, with the finishing machine making its final run over the new concrete. 5. Carrying lip curb concrete across the slab.

Winter Construction

Part I—Expense

A Symposium Covering Expense, Excavation and Grading, Steel Construction, Handling and Heating of Aggregate and Protection of Concrete

THE best argument for winter construction, as far as the contractor is concerned, is that it enables him to keep his organization together and makes it unnecessary to rebuild his construction crew each spring. If a contractor can run his organization through the winter on a contract which will take care of material and labor costs and overhead even at a slight loss he is usually better off than if he does not endeavor to secure a winter contract and pays his overhead, which would include the salaries of his year round employees. The actual added cost of doing work in winter because of the necessary protection of materials and labor runs over a very wide range. One group of contractors selected at random from the Pacific northwest, north central states and the northeast showed several who figure the extra cost at less than 1 per cent, a considerable number at 1 per cent, several at 10 to 15 per cent and one states that his labor cost is 50 per cent greater. This excessive charge is probably an unfair sample as it is from the report of a contractor evidently not accustomed to handling winter work.

Labor Efficiency

Several contractors report that the better quality and greater efficiency of labor in winter completely offset any extra cost which may be necessary due to the heating of aggregates and protection of concrete after placing. In particular, a Portland, Maine, contractor working on a hospital addition contract amounting to $500,000 reported that the extra cost due to the use of the concrete accelerator and the use of protection such as canvas and other covering and wind breakers for laborers was more than offset by the better work and increased efficiency of the labor at that time. A Detroit contractor reports, "It has been our experience that winter construction costs on an average of 10 per cent in excess of warm weather construction. We have found that while labor is more plentiful during the winter weather period and laborers have the willingness to work harder, faster and more efficiently, the physical handicap of the cold weather offset their willingness and about balances up any efficiency derived from that source. Also weather conditions in and around Michigan are of such a nature that it is impossible during the greater part of the winter period to do any work without additional expense for heating materials and affording a certain amount of protection for all skilled labor. This, of necessity, increases the cost."

Costs in Various Sections

Let us examine a few other reports from various parts of the country. A Colorado contractor who built three concrete bridges in winter makes the following statement, "In my opinion, it takes about one-third longer to do this type of work than in normal spring and summer weather. And it costs more. But to keep the pot boiling during a so-called dormant season and to clear the slate for intensive open work, it is worth the effort." An Illinois contractor working on a $150,000 bridge and paving contract, one-quarter of which was done in winter, states that there was an added cost of about 5 per cent on the concrete bridge work and 25 per cent on concrete paving, this latter figure being caused by the difficulty of maintaining a higher temperature over a slab spread over such a large area as in paving. A Chicago contractor who had a $386,000 contract in central Illinois reported an added cost of $1,677 divided between labor and material, $787 and $890 respectively.

An Indiana contractor reported an additional cost of $350 for labor and material on concrete work on a $95,000 contract for a public school building. He states, "We figure it was much cheaper to spend this money for protection as our overhead interest charges, etc., would have been many times greater than $350 if the job had been held up." Along these same lines a Louisville con-

tractor working on a building in Lexington, Ky., the contract price of which amounted to $25,000, states that the extra cost involved because of the work being done in winter was "none ultimately." The costs were undoubtedly higher because of the winter work but were offset by the saving in overhead costs which would have had to be carried over this period with no income had the work been stopped.

TWO REPORTS FROM MINNESOTA

Two Minnesota contractors have interesting reports. One from Minneapolis reports on a $125,000 contract involving four highway bridges, two of which were steel truss bridges with concrete floors, one a steel beam bridge with concrete floor and one concrete bridge, all for the Minnesota State Highway Department, and one steel bridge for a Minnesota county and a 1,200-foot retaining wall at Rochester, Minn. These showed an average of about 10 per cent additional cost because the work was done in winter. The cost of heating aggregates, housing and heating finished work and housing the boilers cost about $2.00 per cubic yard of concrete poured. A St. Paul contractor writes, "As far as winter work is concerned, even in Minnesota we would sooner deduct for winter work than add, strange as that may seem when you consider Minnesota winters. But what is spent in preparing for and heating material is nothing compared to the added efficiency you get from your workmen when jobs are not plentiful, and furthermore, you are always able to buy material cheaper in the winter time than in the busy summer time."

EXTRA COST NOT EXCESSIVE

A Nashville, Tenn., contractor working in Kentucky found that the extra cost on a concrete building amounted to about $1.50 per yard of concrete which included about 0.4-barrel of cement per yard additional and a 10 per cent extra labor cost for pouring and heating the concrete. A Seattle contractor states that the only extra cost in winter work in the Pacific northwest is the time lost by the men in their endeavor to keep warm. Another Seattle contractor working in Alaska reports that on a $47,000 building the extra cost for the winter work was estimated at about $500. They did not attempt, however, to do any concreting in freezing weather in Alaska, and it is very seldom that there are any concrete structures built at that time of year.

From Salt Lake City comes a report from a building contractor stating that he has always been able to get under cover and close in the structure before winter. In this case the extra cost has been for heat which has always been pro-rated according to the man-hours that each subcontractor and the general contractor worked men during the time that heat was required. This cost was about 2 per cent of the pay roll on a high school building for the months of December, January, February and March.

THE NORTH WIND DOTH BLOW—EVEN IN TEXAS

Perhaps one of the most unusual examples of precipitate endeavor to protect a concrete structure comes from a south Texas contractor who says that it is almost never necessary to protect concrete in winter but that he had one experience in which it was very necessary. Pouring had been going on all day in comparatively warm weather. At about 6:30 P.M. a cold wind blew in from the north and the temperature dropped to freezing in 30 minutes. Everyone on the job worked fast covering the bridge with several thicknesses of burlap, hanging tarpaulins that reached to the ground on the north side of the bridge and building fires out of brush and boards under the bridge. Everything in the country around was frozen hard, but there was no damage done to the concrete in the bridge which was kept warm for two days in this manner.

Hints for More Efficient Dragline Operation

SOME proved dirt moving hints which point to more economical dragline operation have been suggested by D. B. Patterson, Vice President, Harnischfeger Corp., with the assistance of Frank R. Kuhn, contractor of Winamac, Ind. Mr. Kuhn is an old-time experienced operator and a successful excavating contractor.

When starting a cut with a dragline, begin close to the machine. By so doing much time can be saved over the method of casting the bucket to the maximum distance at the very beginning. Move the dirt which lies close to the machine first. The more distant dirt will have a tendency to follow into the cut. When the bucket is full, hoist out and get rid of it. Much time and power is wasted when the bucket is pulled along after it is full.

When the dirt is kept cleared away from the front of the machine, the cable does not bury itself when the bucket is hauled in. This not only lengthens the life of the cable, but also enables the operator to cut a smoother, more accurate slope. Furthermore greater depth can be attained close up to the machine.

Hoist and drag cables should be kept tight. When the bucket is cast with the drag cable slack, it may land upside down, backwards, side ways, or almost any other way. This practice not only causes kinking and breaking of the cable, but also results in lost time.

When the hoist cable is kept taut, the bucket can be hoisted the moment it is full. If slack is permitted in the drag cable while the bucket is being hoisted, much of the load spills out.

Water Fit to Drink for Workers on Highways

THAT safe drinking water for state highway construction crews has become a very serious problem coincident with the increased activity in building more and better roads during the past decade was pointed out by Dr. Elmer W. Campbell, D. P. H., Division of Sanitary Engineering, Bureau of Health of the State of Maine, in an article which appeared in the *United States Daily*. It has caused the Maine Department of Health to seek some practicable means of sterilizing drinking water for crews. After considerable experimentation a method was developed which proved reliable where careful supervision can be secured.

It was found that standardized solutions of sodium hypochlorite can be readily adapted to sterilizing water in small quantities. Furthermore, a simple reliable method is available for testing water treated with the chemical, by means of the chemical ortho-tolidin, to see if the water is sufficiently treated or is over-treated. When the water is properly treated and mixed, it is found that after five minutes' standing practically all disease bacteria are killed, and that after twenty minutes the water is completely sterilized, and with no undesirable taste or odor. The hypochlorite is prepared in two-ounce bottles, each containing enough to treat 480 gallons.

Creating a Golfers' Paradise

Construction and Other Features of Bobby Jones' Challenge to Golfers at the Augusta National Golf Club, Augusta, Georgia

ANY golfer looking out over the layout of the new Augusta National golf course could not fail to respond to the challenge and beauty which lie before him. My personal reaction in going over the course during the latter part of its construction was a fervent desire to be able to crack the ball over those undulating pine-sheltered fairways in a long low drive, to loft perfect approaches to the picturesque rolling greens, to sink long curling putts on the velvet carpets of those greens,—in other words, to try my hand at this international game in such unusually beautiful surroundings.

On this course skillful landscape architecture, modern engineering and a natural golfing site have been combined to produce an ideal course, which provides not only superlative golf but also retains all of the natural beauty of rolling hill, valley and forest. The ideal golf course, as defined by the organizers of the Augusta National, is one most pleasurable to the greatest number of players, of increasing interest with each succeeding round, demanding the utmost of the expert in trying for a sub-par score, yet providing an easy route on every hole and opportunity for moderate scores for the player of fair ability and withal, preserving the natural and cultivated beauty of the terrain without apparent artificiality. To such an end did the designers of this course bend their efforts. As an example of these endeavors, there are about thirty sand traps on

No. 15 Green in the Foreground, No. 13 Green in the Distance, Showing the Luxurious Growth of Grass Produced by a Week of Wet Weather

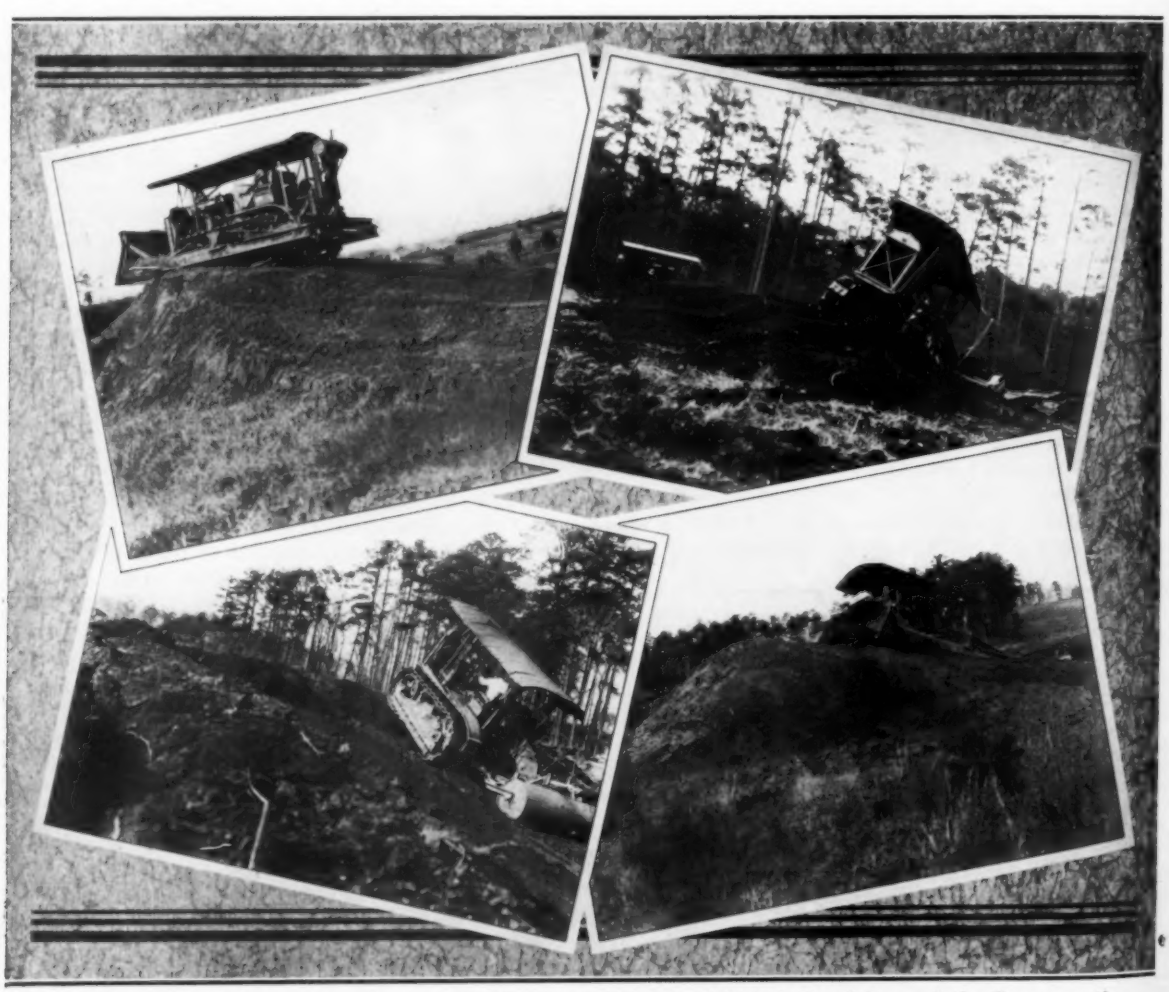
the course instead of well over a hundred as are found on most strictly artificial courses. Instead, the natural, or apparently natural, features of the terrain have been made to create the hazards. It is on the "apparently natural" hazards that the contractors who did the dirt moving worked and to which the critical eyes of the course architect and the world's premier player, Bobby Jones himself, were directed to make the course interesting and its par 72 a real challenge.

The country in which the course is located is ideal from the golfer's angle, from the point of view of the geologist and the naturalist. Augusta is on the edge of the Piedmont plateau and close to the great coastal plain. The late Dr. L. E. M. Berckmans, grandfather of the P. J. A. Berckmans who was born on this property and who is to be the property manager of the course after its completion, established here a magnificent nursery with thousands of varieties of shrubs, deciduous, evergreen and fruit-bearing trees. These have been carefully saved in the design of the course or transplanted to the rough where they will be of interest to all.

SOME OF THE CONSTRUCTION FEATURES

The contract for the clearing and grubbing was given to W. R. Eve of Augusta, Ga., and he started work in earnest in November, 1931. From August, 1931, to that time the designers had tramped the course innumerable times and had staked the location of the tees and greens. Some minor clearing was done during this time for visibility. As soon as the clearing and grubbing contract was awarded, P. J. A. Berckmans, whose grandfather actually originated many of the now common varieties of azeleas, started a race with the contractor to rescue many of the shrubs that were desired to plant in other places as backgrounds for the different holes. In all some 4,450 small trees and shrubs were transplanted, including 50 large holly and magnolia trees which were moved with the usual ball of earth from the fairway into the rough where they now stand as warning sentinels to dubs and experts alike of the dangers that lurk behind them.

Because of the impossibility of awarding a contract for the dirt moving for the creation of the greens and bunkers two contractors who owned the type of equipment most suited to the work rented their machines with operators on an hourly basis. The following equipment was used throughout the work: three Caterpillar Sixty tractors, three Caterpillar Thirties, one Caterpillar Twenty, and two Caterpillar Fifteens; a LaPlant-



Powerful Crawler Tractors Piling Up the Earth for the Artificial Knolls Which Guard Some of the Greens on the Augusta National Golf Course

Choate bulldozer, several sizes of Euclid and Killefer rotary scrapers, a Caterpillar Sixty grader and an Adams grader, two Ball wagon graders, a Killefer road ripper, and International disc harrows and other light equipment for top dressing the grounds.

When the work was underway at No. 3 green and No. 4 tee at the site of an old swamp and a dam and mill, one of the rotary scrapers pulled by a tractor unearthed an Indian grave with relics and bones. In this very location at one time two tractors and eight mules were mired. They were all snaked out by long lines across the swamp and the remaining tractors used as power.

The clearing and grubbing was finished in February, 1932, by the use of stump pullers after the trees had been cut. After the stumps were out the contractor had to plow the entire fairways to a depth of 12 inches to clear them of all roots and other undesirable growths. On February 10, 1932 actual dirt moving, amounting to a total of 120,000 cubic yards, was started, the course was seeded by May 27 and by June 10, the mowers were busy cutting the 90 acres of grass. The construction period of 124 consecutive calendar days included 18 Sundays and 30 days lost because of wet grounds. The actual construction period was 76 working days from the start of surface construction to completion of seeding. The course was in finished condition ready for play on Labor Day, with the formal opening early this winter. It is believed that, considering the volume of dirt moved, the foregoing 124 days constitutes an all-time record in golf course construction.

Figures on a few of the specific dirt moving jobs will be of interest to contractors. No. 3 green was created by moving 5,000 yards of earth from one side of a creek to cover a rock ledge on the other side. Mules and wheelers did this work. On No. 8 hole there is a large group of artificial knolls which required 6,500 yards of earth which was also put in by mules and wheelers and backed up by the tractors and scrapers. The various greens and the fairway hillocks averaged 4,000 yards of earth each with at least six greens running far beyond this figure.

The fairways were prepared with graders and disc harrows after the plowing which buried the Bermuda grass that was quite profuse throughout the open fields formerly used for nursery crops. Then the Ball wagon graders were used to haul the top soil from adjacent open areas with the stolons of the Bermuda grass and this was spread over the fairways, mounds, swales and approaches. The cost for hauling top soil on the shorter hauls of about 400 feet to 600 feet was 15 cents per yard with top costs of 24 cents on the longer hauls. Carload lots of Florida peat humus amounting to a total of 500 tons were used, 75 tons of Milorganite, a fertilizer made from the sludge of the activated sludge sewage disposal plant of the city of Milwaukee, Wis., and 30 tons of super phosphate and potash were used, also 8,000 pounds of Bermuda grass seed.

TILE DRAINAGE NECESSARY

Because of the heavy clay soil covering most of the property and the large number of seepage areas, it was necessary to install an extensive underdrainage system. A total of 2,400 feet of vitrified sewer pipe, ranging from 10 to 21-inch, and 14,000 feet of open joint farm drain tile was installed by hand labor. The farm drain tile was covered to within 8 inches of the ground surface with pea gravel, using in all approximately 2,000 yards of gravel. The total area drained was 15 acres.

A View of No. 10 Fairway Showing the Layout of the Irrigation System

THE HOSELESS IRRIGATION SYSTEM

The Miller high-pressure hoseless irrigation system for furnishing plenty of water uniformly spread over the entire surface of the fairways consists of Buckner Super valves with sprinkler attachments which throw a spray 200 feet in diameter. The entire 170 feet width of the fairway can thus be sprinkled at one time for the entire length and without the need of pulling hose over the turf. On the greens and tees the Buckner hoseless system of pop-up sprinkler heads is used. These are set just below the ground level and when turned on the heads pop up and rotate and spread a fine spray of water over the surrounding turf.

For the irrigation system water is taken from a 30-inch raw water main of the city of Augusta which runs through the lower end of the property. An 8-inch line from this main provides water for all the sprinklers through 8-inch down to 1¼-inch McWane cast iron pipe using 27,412 feet in the entire irrigation system. The amount of water taken from the city line is measured by an electric Republic flow meter with 24-hour flow charts and flow integrator. All the pipe was placed in a hand-excavated trench with 18 inches of cover.

Filtered water for the clubhouse and the drinking fountains on the course is taken from a city main through a 6-inch McWane cast iron line 4,100 feet long and is distributed over the course to the fountains in 2,700 feet of 1¼-inch pipe.

PERSONNEL

This great course which is destined to become world famous is located on the outskirts of Augusta, Ga., a city of 60,000 population. The project was started by Grantland Rice, Clifford Roberts and Robert T. Jones, Jr. Augusta National Golf Club is the official club name, with Mr. Roberts as Chairman of the executive

committee and Mr. Jones as President. The club will have 1,500 carefully selected members scattered throughout the United States and foreign countries so that not more than the number which can be normally cared for on the course at one time will be playing there simultaneously. Bobby Jones has spent the greater part of the last twelve months on the course with the architect, Dr. Alister MacKenzie, in locating the various features to the best advantage. Dr. MacKenzie is the designer of over 300 courses on five continents and is architectural consultant of the famous R. and A. St. Andrews' and St. George's courses in Scotland. Actual construction as well as the drainage, irrigation and turfing, was personally executed by Wendell P. Miller and Associates, Consulting Engineers of New York and Chicago. The estimated cost of the course, exclusive of land and buildings, was $100,000 but efficient management, favorable weather, and the low cost of labor made it possible to add $15,000 worth of facilities not in the original estimate and still complete the project well within the original figure.

The two Augusta, Ga., contractors whose services and equipment were used in the construction of the course were Wm. F. Bowe, Jr., and Claussen & Lawrence. The Caterpillar tractors were furnished to the contractors and serviced by the local Caterpillar Tractor Co. representative, the Georgalina Tractor Co.

Pouring a Single Widening Strip with Two Pavers

(Continued from page 20)

the minimum of effort. They dumped the concrete along the form so that it did not have to be shoveled again.

The curb was made by one builder and one setter with a finisher working immediately behind and two other finishers working about 20 feet farther back smoothing down and edging. The smoothing was done with a piece of burlap dragged over the concrete. The method of building the lip curb was somewhat unusual and is worthy of description in detail. It will be noted that the organization mentioned as building the curb is a little larger than usual. The results and speed of building warranted it. The builder simply used a hand float and stacked up the concrete as it was dumped by the two carriers. He left it fully 3 inches higher than the finished curb and not compacted. The setter used a 15-pound "mule" shaped to the final form of the curb and pounded the concrete down with it, compacting it and finally running the mule over the shaped concrete to give it a floating. The "mule" had a hook made by bending the sheet metal over along the upper end so that it lapped down over the curb form for about 1 inch, giving a definite limit to the action of the steel float.

On the finished slab there was a tolerance of ⅛-inch which was maintained with regularity. In places where there were high spots shown up by the straight-edge after the concrete had set the bumps were ground down by a Berg concrete surfacer. The transverse dummy joints were poured by two men using a Littleford asphalt kettle which was dragged along the old slab. The grinding and pouring were done by the same men.

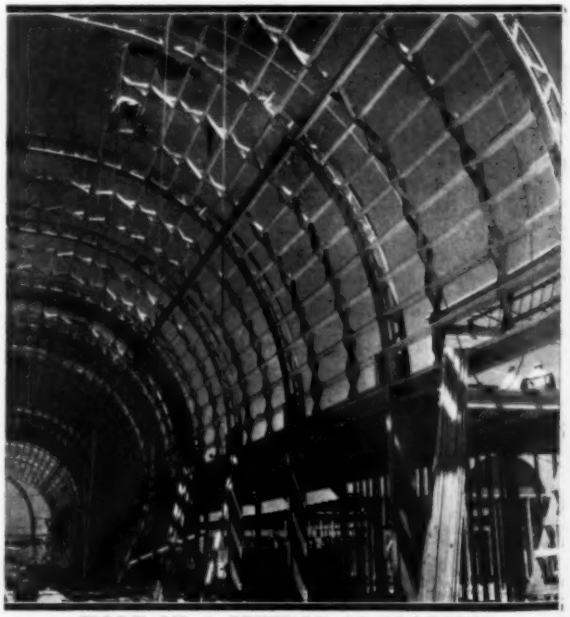
HANDLING THE AGGREGATES

The hauling of the batches to the paver was handled by a subcontractor. Limestone from the Wagner quarries at Sandusky, Ohio, was shipped in by rail in hopper-bottom cars and dumped from a trestle at the yard of a local coal dealer. Sand was received in a similar manner from the pits of the American Aggregates Corp., at Massillon, Ohio. A P & H crane with a 58-foot boom and a ¾-yard Williams clamshell bucket moved the aggregates from the piles beneath the trestles and loaded the Blaw-Knox bins which were equipped with Erie batchers. Two men worked in the sand cars when they were being dumped and one in the stone cars. Additional labor included the crane man and the weigh man who also delivered the batch tickets to the truck drivers. About eight cars of aggregate were unloaded a day to furnish the materials for the 1,412 feet of slab poured by one paver with two 7-hour shifts on the road. The batches consisted of 1,750 pounds of stone, 1,440 pounds of sand for the six bags of cement. The batches were mixed 1¼ minutes in the paver.

A fleet of trucks hauled the proportioned aggregates from Chagrin Falls, a distance of about 2 miles dead haul. They stopped at a cement storage shed by the side of the road where three men loaded the six bags of cement. These were emptied later and nearer the paver by two other men.

PERSONNEL

This 6.754-mile contract was started on June 10 by the Clements-Orr Co., Cleveland, Ohio, and completed November 23, 1931. W. M. Ramey was Superintendent for the contractors and the work was in charge of R. B. Kennedy as Resident Engineer for the Ohio Department of Highways.



WORK ON A CENTURY OF PROGRESS BUILDING

Carpenters at work on the steel frame joining the wooden supports for the roof of the Agriculture Building for which the E. W. Sproul Construction Co. is the general contractor

A Paving Job That Divided Itself

Into

A Series of Heavy Cuts

Light Cuts with Shovel and Grader

Typical City Paving with Manholes to Set

THERE are times when the extension of a paving project after the original bid has been recorded is a blessing and gives the contractor a chance to profit by the fact that his equipment is on the job and ready to go. This was not the case, however, on the Lewis & Frisinger contract on Route M 60, a relocation of the old road for 9 of the 13.15 miles, between Niles and Galien, Michigan. The first and original contract was through the relocation and had heavy cuts and some slight cuts. The extension of the job was through the city streets of Niles and involved intersections, setting manhole tops and other interferences with the usual rapid progress of a highway job which are attendent on city work. Contractors well know what it means if a manhole cover is high on a concrete paving job; the casting must be dug out, the reinforcing cut, the top reset, then the whole reset and the finishing machine brought back over that section again. Well, no one does that on purpose but it does happen "in the best regulated families" and it delays the work, much to the consternation of the superintendent.

How the Job Split Up

The original route of M 60 was from Niles through Buchanan and thence with many right turns on to Galien. The relocation followed a more southerly route, running about 1¼ miles south of Buchanan with 9 miles of new location and the remaining distance over county roads.

The east end of the job had light grading which could be easily handled with the shovels in cuts of 6 inches to 6 feet with from four to six trucks working with each shovel. The hauls averaged from 500 to 700 feet. At the extreme east end of the original project was the extension which amounted to city paving at the price of regular through-highway work. The western end of the job had cuts from 6 feet to 22 feet in depth and only small fills. The large excess of excavation was not wasted for this end had the added trials of a number of muck holes. Into one of these, across the neck of Dayton Lake, a total of 40,000 yards of fill was put in within a distance of 250 feet. The muck holes ran from 10 to 20 feet in depth, with a few exceptions that had to be treated with dynamite or the new flushing method practised by the State Highway Department. When the muck holes were relatively shallow they were filled directly and allowed to settle. If over 18 feet the contractors resorted to the usual dynamiting.

The new flushing method which was experimented with last year in Michigan consists of loading the muck with a heavy surcharge of earth and then developing 20 to 80 pounds pressure in 16 to 20 jets simultaneously under the fill and flushing the muck out. When the fill drops, if it is below the desired grade it is again surcharged by the contractor. All the flushing was done by the state. The amount of original surcharge depends on the resistance of the muck to loading, the greater the resistance the higher the surcharge. From 12 to 20 feet of earth usually secured the desired results.

In the deepest cuts the haul was as great as 1,800 to 2,000 feet to the muck holes. In the shallow holes the muck was excavated with a Koehring ¾-yard dragline which also worked in the marl deposits along the right of way. This material was soup in the hole, but when it was thrown on the bank and allowed to dry it was easily worked with the bulldozers. On the completion of the rough grading the fills were graded with an Adams No. 12 leaning wheel grader with a 12-foot blade pulled by a Caterpillar Sixty.

Two Locations for the Batching Plant

For the first part of the paving the batching plant was set up about 4 miles from the east end of the job and about 500 feet off the right of way on a railroad siding. For the second part of the work it was moved to about a mile from Galien to another railroad siding. This gave total maximum hauls of 4 miles both east

Emptying Six Bags of Cement into Each Batch Box of the 12-Car Train at the Cement Platform

and west for the industrial railway from the first set-up and 4¼ miles east and 1 west from the second location.

Twelve-car trains of Lakewood cars and batch boxes were used as the hauling units with two boxes per car. As there were several 6 per cent grades in the haul along the shoulder of the road there were booster engines located along the right of way, and at the plant and paver the trains were split into two sections with a locomotive for each for ease of handling. There were two 8-ton Plymouth locomotives, two 7-ton of the same make and two 7-ton Milwaukee locomotives, all gasoline powered. When a 12-car train approached the batching plant down grade the first six cars ahead of the locomotive were taken by the yard locomotive and run through to the batcher by way of the receiving track. After loading they were run onto the outbound track to the cement cars where they were left by the yard locomotive. Then the hauling engine took them and spotted them for the cement in the various cement containers, one for each batch box. In the meantime the yard locomotive went back and picked up the other 6-car section and ran that to the batcher, loaded it and brought it forward to the cement cars. The hauling locomotive, after the cement had been loaded into the first section, took that section to the top of the hill to a switch and then returned for the second section at the cement cars. There were a locomotive engineer and a brakeman for each locomotive, the brakemen making up the train and assisting in spotting the cars at the batching plant and the paver.

The trains were similarly broken up at the paver, one section being handled by the hauling locomotive and the other by the shifting locomotive. This was necessary because the use of a full 12-car train at the paver would have interfered with the work of the finishers.

Sand and stone for this job were received in different ways. The stone was shipped in by rail in hopper-bottom steel cars from McCook, Ill. by Dolese & Shepard and delivered into a stone pit beneath the track from which it was clammed by the Osgood gas crane with 45-foot boom and 1-yard Blaw-Knox bucket. The sand was delivered by truck to another pit, a haul of 9 miles, by Brown & Rosenbarger of Indianapolis, Ind., from a pit at Bertrand, Mich. There were adequate stockpiles of both sand and stone. The crane delivered to the Blaw-Knox bins or to the stockpile as required. When loading a 12-car train the crane delivered to the bins are rapidly as possible to maintain a free flow of materials.

Alpha and Wolverine cement was received in carload lots in cloth bags and dumped, six bags to a cement container, in each of the batch boxes by four men in the car while the locomotive spotted the cars so that there would be two cars in front of the door at one time for the men to work on. The average batch of aggregate was 1,444 pounds of sand and 1,888 pounds of stone for the six-bag batch.

The complete yard crew on this job consisted of two pit men in the aggregate cars, one crane man, one batcher man, four men on cement, one yard locomotive engineer and a brakeman and a mechanic. An ample yard was maintained for the storage of extra parts and materials for the job were all stacked neatly on the ground or in the tool house.

Preparing the Grade and Forms

The rough grading on this project was started October 1, 1930, with two Osgood 1-yard gas shovels, one Northwest 1-yard gas shovel, a 1¼-yard Lima shovel and two ¾-yard Koehring shovels, one of which was rigged as a dragline. There was 475,000 yards of excavation on the job without any rock, but at one time with all six shovels working each was in a different material. The various materials encountered included "ginger sand," which is understood to be one size larger than blow sand, sandy loam, peat, sandy clay, hard clay, blue clay, and mixtures of all of them. The work was shut down between January 5 and April 10, 1931, during the winter. Concreting was started May 18, 1931, and completed October 15, 1931, with the job ready for the final estimate on December 15, 1931.

The fine grade crew consisted of nine men which included the two form setters, and the operators for the Huber 10-ton gas roller, the Galion one-man power grader with 10-foot blade, and the Caterpillar Sixty tractor. After the line of the grade was set with the usual pins and cord a Ted Carr Formgrader cut the form trench for the 9-inch forms. The Blaw-Knox forms were usually set from 500 to 600 feet ahead of the paver and the power grader and the roller completed the grade promptly after. The roller pulled a Lakewood subgrader along the forms to give the final cross section to the grade about ½-inch above the grade which was to be poured, that being cut by the Carr subgrade planer pulled by the Rex 27-E paver.

Progress at the Paver

Instead of using welded wire fabric for this contract the Lewis & Frisinger Co. made up its own mats of ⅜-inch round bars placed in frames and wired with automatic tying tools. The rods were about 13 feet long longitudinally and 10 feet long transversely. The spacings were five bars spaced 9 inches apart on the outer sections of each mat and two spaces of 18 inches at the center. The bars projected about 3 inches beyond the outside bars on all sides. The transverse bars were spaced 2 feet apart for the entire distance. Three men handled the preparation of the mats ahead of paving operations and then came back and maintained the track at the paver. There were in addition eight men who maintained the 4 miles of track and switches over

the job. These men also looked after the maintenance of the water line along the shoulder.

The paving crew which worked with the regularity of clockwork consisted of a foreman, three men to dump the batch boxes and one man on the hoist of the paver as well as the paver operator. One man ahead oiling forms sprinkled the grade and moved the water hose ahead with each move of the paver. There were two "tail graders" or "log men" as the old time foreman called them from the original drag that was carried behind the paver to smooth off the grade before it was required to cut the grade to a definite line. Four puddlers spread the mix and two spaders kept the sides trimmed up to reduce the spilling of concrete over the forms and also shoveled to the Lakewood screed.

There were two men on the steel mats and the center cross dowels. These two men kept the mats lined up for each section, two piled on top of each other and loaded the novel dowel spacing machine with the seven ⅝-inch x 4-foot dowels. When it was time to place the steel on the lower course of concrete the steel men, without stepping into the concrete, handed the dowel spacing machine to the puddlers who laid it on the concrete, pulled the bar and dropped the bars exactly into place. Then the steel men handed in the first mat which was placed on the near side. While the concrete was being puddled on the far side ready for the second mat the steel men tossed in the second mat on the first where it would be in readiness for the puddlers.

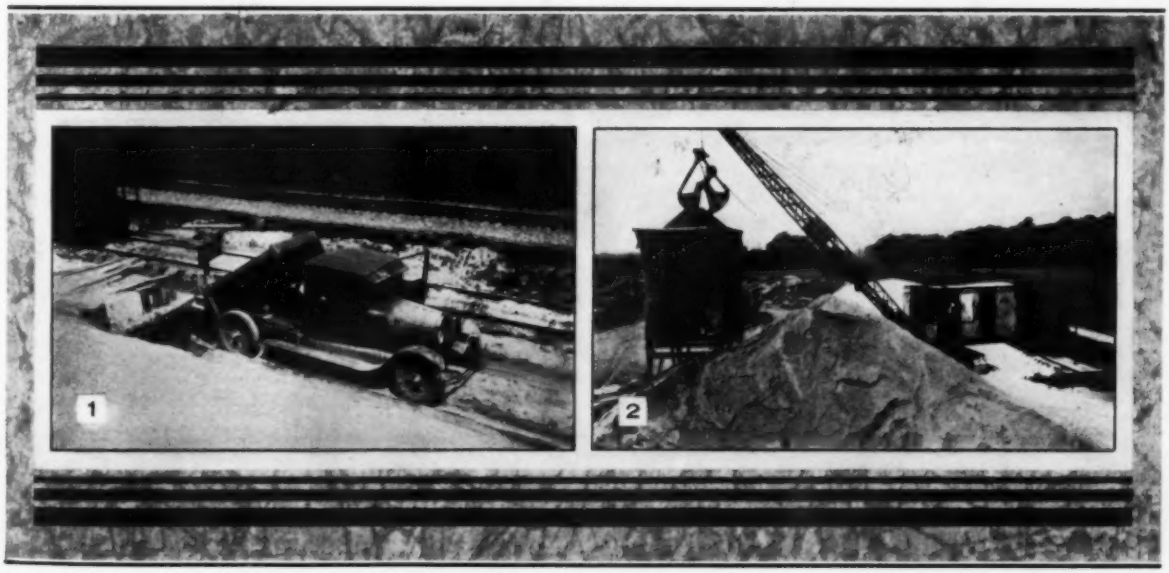
THE DOWEL PLACING MACHINE

Having had considerable argument with inspectors in the past over the accurate spacing of the dowels which are placed below the mats of reinforcing steel and across the center joint, the concrete foreman, Bert May, devised a simple machine that does the work without any possibility of argument. The machine consists of two pieces of 1 x 3½-inch plank on edge and planed, spaced 5 inches outside measurement. At the top these are firmly held together every 18 inches by 3 x 5-inch blocks of 1-inch material for rigidity. This makes a U-shaped box. At the bottom of the 12-foot side pieces there are notches cut at 2-foot intervals for the insertion of the dowels, this alone assuring the proper spacing. To hold the dowels in place when the machine is inverted there is a J-bolt for each bar. These bolts are attached to a strip of iron 1 x ¼-inch, running the full length of the device and a little beyond at each end. This is held in place and permitted to slide freely in blocks at intervals of about 3 feet. When the dowels are in place the iron strip is pushed forward so that each J-bolt engages one dowel and holds it firmly in place while the device is inverted. Then when the dowels are to be placed in the road the device is simply laid on the green concrete, the iron strip pulled back and the dowels are released and accurately spaced; and with no argument with the inspector over careless tossing of the dowels into approximate position.

FINISHING THE SURFACE

Behind the finishing machine there were two hand finishers who used the long-handled floats and the wooden straight-edges. These were made in the shops of the contractor and when first delivered to the road were altogether too heavy for even the huskiest finisher to use continuously throughout the day. During the noon hour one of the men borrowed a bit from the tool box of a fellow laborer and bored several dozen holes in each straight-edge, greatly lightening the burden and also making them much less liable to warp during use on the road as the moisture has little chance to make its way up through the perforated plank without being largely dissipated through evaporation.

One center joint man with a National Steel Fabric Co. machine set the strips of Elastite along the center and hand floated the joint to a smooth finish. Attached to the back of the machine was a drag of burlap to



HANDLING AGGREGATE ON THE LEWIS & FRISINGER CONTRACT ON MICHIGAN ROUTE 60

1. Sand was delivered by truck to a pit from which it was removed by a clamshell bucket to the stockpile. 2. Handling aggregate from the stockpile to the batching plant required fast work when loading a 12-car industrial train.

roughen the top to a uniform texture. Back of the center joint man came the two burlap men who carried 22-foot strips of burlap on a Carr rolling bridge. These men also edged the pavement and sprinkled the burlap.

The curing of the slab after the removal of the burlap was by hay sprinkled for 10 days. This work was done by subcontract, but the actual sprinkling was done by two of the contractor's men.

The organization described above usually poured and finished between 900 and 1,000 linear feet of slab per day, 9-7-9-inch uniform thickness and 20 feet wide. The Elastite 1-inch expansion joints were placed every 100 feet and at noon and night at intermediate intervals when the cessation of work was not at the regular joint. The joint was made up against a wood bulkhead cut to the crown of the road and staked with five pins. The joint material was set in two 10-foot lengths for convenience in handling.

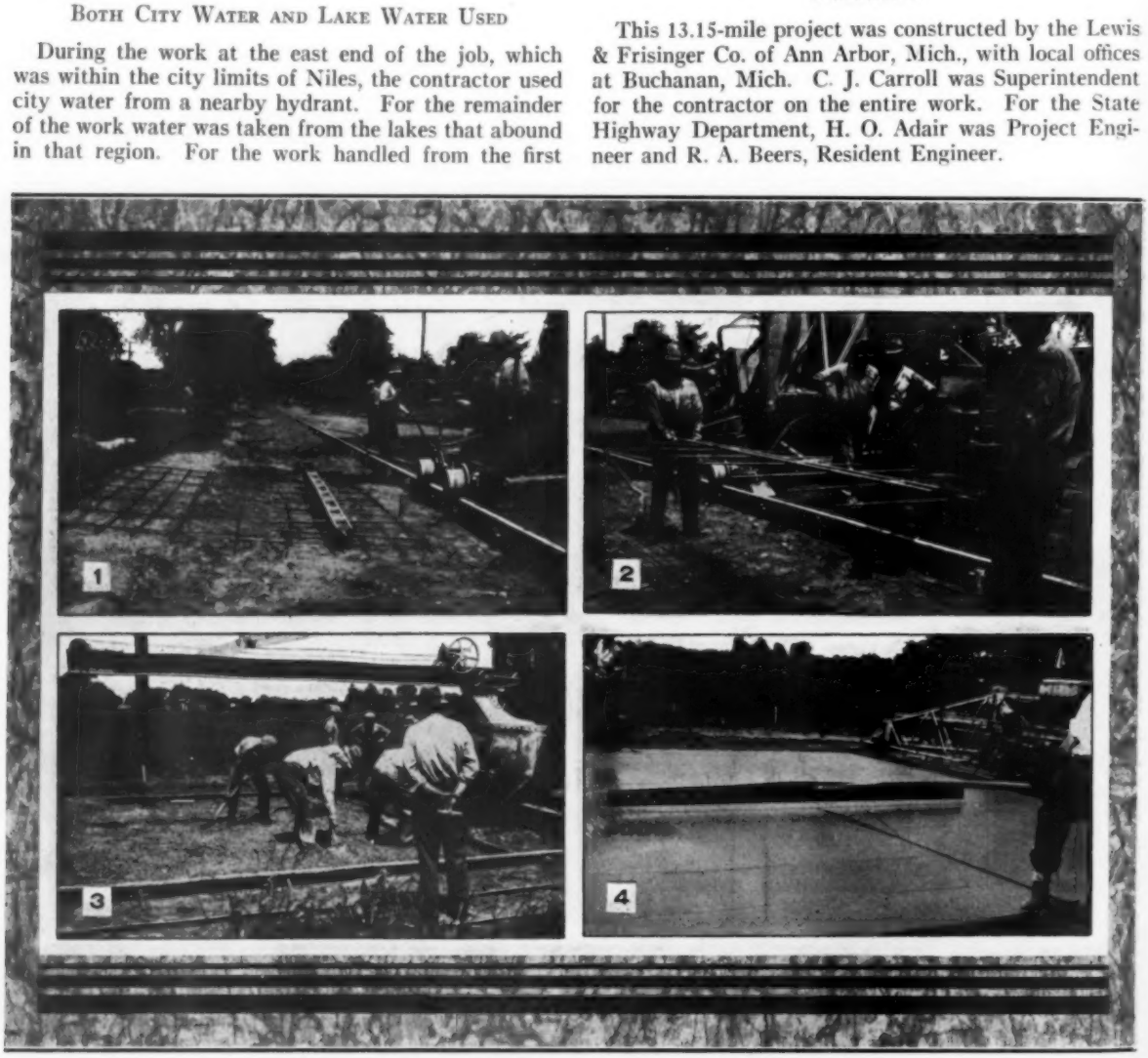
BOTH CITY WATER AND LAKE WATER USED

During the work at the east end of the job, which was within the city limits of Niles, the contractor used city water from a nearby hydrant. For the remainder of the work water was taken from the lakes that abound in that region. For the work handled from the first batch plant location only one pump set-up was used and the water was pumped as far as 2 and 3 miles. On the second part farther west the pump was located at as many as six different places and the pumping distance was never more than a mile. A Barnes triplex pump was used with a 2½-inch pipe line throughout the work with the exception of the city work where a 2-inch line was used. A C H & E triplex was used as a standby in case of emergency. Taps for the paver hose were placed every 150 feet and the paver carried a similar length of Continental 2-inch red rubber hose. The connections between the hose and valve were made up with Mulconroy rapid hook ups which were tightened or loosened with a hammer on the heavy lugs.

All equipment on this job was regularly supplied with gasoline by contract with the Standard Oil Company of Indiana, each operator signing for the gas.

PERSONNEL

This 13.15-mile project was constructed by the Lewis & Frisinger Co. of Ann Arbor, Mich., with local offices at Buchanan, Mich. C. J. Carroll was Superintendent for the contractor on the entire work. For the State Highway Department, H. O. Adair was Project Engineer and R. A. Beers, Resident Engineer.



POURING AND FINISHING THE 20-FOOT CONCRETE SLAB

1. A pair of reinforcing mats and the dowel placing machine loaded and ready on the shoulder. 2. Two men holding the dowel placing device ready to turn it over and hand it to two of the puddlers. 3. The four puddlers spreading the first batch on top of a pair of reinforcing mats. 4. A wooden straight-edge with holes like this is less liable to warp and is much lighter than a solid plank.

Drilling *and* Blasting *in* Highway Grading

Part II

Reported by
Andrew P. Anderson

Highway Engineer
Division of Management
U. S. Bureau of Public Roads

WHILE notable progress has been made in effecting higher rates of production in practically all other lines of highway work, the rate at which drilling and blasting is handled has shown no appreciable progress during the past six years, for which the U. S. Bureau of Public Roads has available definite records based on production studies on a large number of going projects. These data, while not sufficiently extensive to be entirely conclusive, are nevertheless sufficient to indicate that for identical equipment there has been during this period no material increase in the efficiency with which the drills are operated, in the footage of holes drilled per hour of actual operation, or in the rate of production of the shovel while handling blasted material. Nor is there any substantial evidence of a definite decrease in the time losses in drill operation, in the amount of either drilling or explosives required per cubic yard or pay excavation, or in the time losses imposed on the shovel by the operations of drilling and blasting. The trend toward the use of larger shovels, however, has been rather marked and the proportionate loss of time has therefore been somewhat reduced.

From these indications one might argue that further progress in handling rock excavation in highway grading is impossible or at least improbable; but, while the records of past performance are far from inspiring, they are not as hopeless as these generalities would indicate. Out of the seventy-one jobs there were fifteen which attained practically as high a rate of production in rock as is usually secured in common excavation. One group of 1 to 1⅛-yard shovels working in material classified as "good to fair common" operated on an average cycle of 21 seconds while moving 93,000 cubic yards of material, while another group of shovels of the same size working in material classified as "rock, well blasted. very few pieces too large for dipper" also operated on an average cycle of 21 seconds while moving 48,000 cubic yards of material.

The average dipper load of the shovels working in common was 0.66 cubic yard of pay material while for those working in the well-blasted rock it was 0.61 cubic yard. Thus, for the time these shovels were actually digging, the rate of moving cubic yards of pay material in well-blasted rock was 92 per cent of the rate maintained by the shovels working in good common. But, probably because of a somewhat better supply of hauling equipment, the time losses on the rock jobs were about 6 per cent less than where good common was being handled, so that the actual production per hour on the rock jobs was only 2 per cent below that attained on the earth jobs. Based on the total time the crews were on the job, the actual production of pay yardage was 57.5 cubic yards per hour for the shovel working in good common and 56.4 cubic yards per hour for the shovels working in well-blasted rock. The ordinary time losses or delays, while rather unusually high, were very nearly the same for both sets of shovels, 49 per cent for those working in common excavation and 46 per cent for those working in rock. In both cases the major portion of these time losses was due to insufficient hauling equipment.

Other Conditions Which Reduce Efficiency

On the great majority of jobs on which rock is encountered, it is usually covered with more or less overburden so that advance determination of such important factors as the exact amount, character, and condition of the rock, the dip of the strata, location of seams and bedding planes, etc., is difficult. Sometimes considerable rock is encountered where none had been expected. As a rule, the depth of rock to be removed in these cuts is comparatively small, seldom above 20 feet, on many jobs rarely over 4 or 5 feet and frequently only 1 or 2 feet. The limitations placed on either over or under breakage on the side slopes, and frequently even in regard to the grade line, are rather numerous.

Careful consideration must also be given to preventing injury to persons, passing traffic and neighboring improvements. The shooting must, therefore, as a rule, be as light as possible. But light shooting and thorough breakage of the material can only be achieved through correct depth and placement of drill holes which have been properly loaded with the right amount of suitable explosives and then properly fired. Even heavy shooting frequently fails to break up a hard or tough material properly unless the charges have been both placed and spaced correctly. Success can be attained only through a correct coordination of all of these factors while a substantial error in any one is almost certain to result in a costly failure. Since drilling is usually the most expensive item in the type of rock work encountered in highway grading while improper location, spacing, or depth of the drill holes is also the most frequent cause of poorly broken material, we shall discuss this item in more detail.

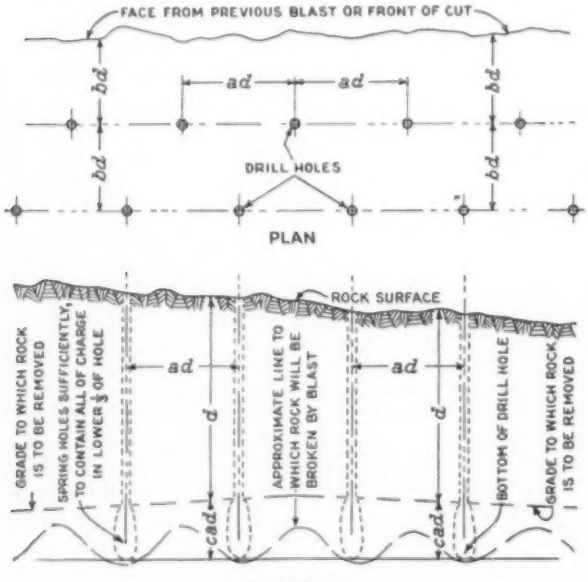
SPACING THE DRILL HOLES

The following diagram shows a part of a rock cut where two rows of holes have been drilled. It will be observed that the holes are staggered. The relations between the spacing of holes, depth of cut and depth of drill hole below grade is expressed as follows:

a = Ratio of depth of cut to spacing of holes across cut.
b = Ratio of depth of cut to spacing of holes from face, or of rows across cut.
c = Coefficient of depth of drill hole below grade. Its value for most materials lies between one-fourth and one-half, except in very shallow holes.
d = Depth of cut at drill hole.
ad = Distance between holes across cut.
bd = Spacing of rows or distance of holes from face of cut.
cad = Depth of drill hole below grade to which rock is to be removed.
$d + cad$ = Total depth of drill hole.

In this arrangement the drill-hole spacings parallel and perpendicular to the face of the cut are not equal, but each is a function of the depth. The depth drilled below grade is a function of the spacing rather than the depth.

A review of all the field records for jobs working in reasonable homogeneous material shows that the spacing between the holes in a row across the cut averaged about three-quarters of the total depth and usually varied from one-half to slightly more than the depth of the holes. The spacing of the holes from the face or between rows averaged slightly less than the spacing between the holes in a row. In such materials as ordinary shale, disintegrated granite and hardpan, the spacing in deep cuts sometimes equaled twice the depth of cut but was usually about 1 to 1½ times the depth of the cut. There was a rather strong tendency, however, to adopt and maintain a fairly constant spacing for any given cut regardless of the variation in the depth of individual holes.



Suggestions for Placing Drill Holes—The Diagram Shows the Plan and Elevation of a Section of a Through Cut

Too frequently the exact placement of a hole was determined by the existence of a good place to drill rather than by the relative distances to adjoining holes. The depth drilled below grade was most frequently an arbitrary constant for any given cut with but little or no variation for different depths of the individual holes. Thus, on one job on which the depth of cut varied from 2 to 10 feet, and the spacing from 2½ to 6 feet, the depth below grade was always 2 feet. On a second job on which the depth of cut varied from 5 to 20 feet and the spacing from 4 to 10 feet, the depth below grade was always 2 feet. On a third job in disintegrated granite with cuts from 5 to 24 feet and the spacing about equal to the depth, the depth below grade was always 3 feet, while on a fourth job with cuts mostly 10 to 20 feet deep and a spacing of about 12 feet between holes and 8 feet between rows, the depth below grade was always 4 feet. Examination of the scheme for placing drill holes shown above will show why such practices are likely to result in improper fragmentation or shattering of the material and high unit costs.

TWO-FOOT DRILL HOLES ARE COSTLY

If the distances between holes and rows as well as the depth of the holes are given in feet with the designations as indicated in the diagram, we note that the volume of material above grade line may be expressed in cubic yards for each hole as

$$V = \frac{abd^3}{27}$$

while if D be used to designate the linear feet of drilling required per cubic yard of pay material, we have

$$D = \frac{27\,(1 + ac)}{abd^2}$$

Thus, within those limits in which the ratio of the drilling of holes and rows as well as depth below grade holds true, the volume of pay material per drill hole varies directly as the cube of the depth of the cut and the amount of drilling per cubic yard of pay material varies inversely as the square of the depth of the cut. The amount of explosives required per cubic yard of any given material, however, varies only slightly with the depth of the holes. These facts help to explain why the unit cost of removing shallow cuts of hard rock is so high.

If we consider, for example, four cuts of the same kind and character of uniform solid rock, the first of which is 2 feet deep, the second 4 feet deep, the third 8 feet deep and the fourth 16 feet deep, in which both rows and holes can be spaced at three-quarters of the depth of the cut and the depth to which the holes must penetrate below the grade is one-fourth of the spacing between the holes, then the amount of drilling, in linear feet, required per cubic yard of pay material for each cut is as follows:

(*Continued on page 38*)

Penetration Macadam *on* Gravel Base

Standard Construction Used on 8-Mile Job Near Historic Plymouth Involved Over 124,000 Yards of Excavation

IN its 1931 construction program the Commonwealth of Massachusetts replaced a number of miles of old narrow bituminous pavement with its standard mosaic penetration macadam, particularly on the through routes. North of Plymouth from Kingston through West Duxbury to North Pembroke 8 miles of new penetration macadam was built 30 feet wide. Of this about 5 miles was relocation. The Eastern Contracting Co. started work on May 10 on the contract which was let April 27, 1931. The work was completed in November.

Rough Grading and Excavation

The excavation required the removal of 124,500 cubic yards of earth, and the gravel foundations involved the placing of 46,000 cubic yards of this material. The specifications called for the stripping of all sites of fills of 4 feet or less. The stripping from the cuts and these fills had to be wasted and considerable trouble was experienced in finding places within reasonable hauling distance where the material could be damaged. There was a total of 30 acres which was stripped until firm earth was reached. The brush and stumps were burned on the right of way under the watchful eye of the local fire warden.

On excavation the contractor used seven shovels at various strategic points to push the work with the greatest speed. These included two Bucyrus-Erie steam shovels, one Gas+Air and one gas of the same make, one Lorain, one Link-Belt and one Northwest shovel. There were two Caterpillar Sixty tractors with bulldozers and one Monarch 50 similarly equipped for the completion of the fills. The rough grade was smoothed out by two graders with 10-foot blades which were self-propelled by small Cleveland tractors built into the machines.

At the Pembroke end of the job the contractor ran into a clay bed that was particularly bad when wet. The one ledge on the job which required the attention of a drilling crew and numerous applications of Hercules 60 per cent dynamite in holes drilled with I-R jackhammers and compressor also offered questionable entertainment after even the slightest rains when many springs started up and gave a considerable flow of water in the vicinity. At one point where a muck hole about 300 feet long and about 7 feet deep was encountered the Northwest shovel was run into the hole and the muck cast out to the side, as the owner of the adjacent property wanted the black muck for a garden. Not always are the contractors so blessed when muck holes are met. In the middle west where the contracts call for the top-soiling of all cuts contractors are now saving the muck from such pits of iniquity and letting it drain, then rehandling it and placing on the cuts after hand dressing, thus saving the cost of loam from farm lands.

Drainage

Drainage for the various small streams crossing the right of way was provided by about 16,000 feet of 12 to 48-inch pipe. Both vitrified clay and reinforced concrete pipe were used; the former in 12 and 15-inch sizes and the latter from 12 to 48 inches in diameter. There was 38 feet of cast iron pipe, 12-inch diameter, for one location where the cover was shallow. Many of the pipe installations were extensions of existing culverts.

Gravel Base

To provide proper drainage and thus prevent the rising of ground water by capillarity in the winter, causing frost boils which are so destructive in other New England states and in some middle west states, a 12-

The Only Ledge on the Job Required Some Heavy Blasting Which Scattered Rock for Considerable Distance in All Directions

inch gravel foundation was laid for 20,000 feet through Pembroke and Duxbury and an 8-inch gravel base for the remainder of the work. The gravel was hauled from two pits each about 1½ miles off the right of way, one a mile beyond the north end of the job and the other about 2 miles north of the south end of the work. All gravel was rolled with a 14-ton roller.

Truck Hauling on the Job

The contractor used his own trucks for the gravel hauling on the job while the Old Colony Crushed Stone Co. of Quincy, Mass., used its own trucks for hauling the stone which it furnished for the construction of the penetration macadam. The stone was hauled direct from the quarries for the northerly end of the job and from a rail siding for the Duxbury and Kingston end. The hopper-bottom cars were unloaded into a pit from which a Burch unloader carried the stone direct to the trucks. The Old Colony fleet consisted of ten Stewart and seventeen American LaFrance trucks each equipped with a 4-yard body and Wood hydraulic hoist. The capacity loads were about eight tons. All trucks on the job whether belonging to the contractor or material contractor were equipped with dual pneumatics in the rear. There was a total of about sixty trucks working on the job at its height.

Applying the Stone

The base course of crushed stone was applied with Burch stone spreaders so that it would roll to 4½ inches. This stone was 60 per cent 2-inch and 40 per cent 1¼-inch screen size. There were four stone spreading crews with two men on the spreaders which were worked in parallel down the road, and two to four men with stone forks and four men on two "bull rakes" or the usual double handled long-tined rakes worked back and forth by two men, and one foreman for each stone spreading crew. The stone was immediately rolled with one of the six 14-ton Buffalo-Springfield gas rollers and then bound with hand cast sand until the top voids were filled to prevent the penetration of the asphalt into the base. During the rolling of the base course care was taken to roll the shoulder for a distance of about 18 inches so that the base would not be squeezed out into the shoulder and wasted. The two sanding crews consisted of ten men each who hand cast the sand and broomed it into the base course.

The 2½-inch top course was spread in a similar manner with 2-inch stone and then rolled with the 14-ton rollers lapping the shoulder in the same manner as for the base course.

Applying the Penetration Asphalt

Socony Binder C asphalt of a penetration of 85 to 100 was used until September 30 after which Binder B, of 100 to 120 penetration, was used. The asphalt was delivered in tank cars at the siding in Duxbury, heated by a special booster heater with oil burners and then pumped into the Merrill distributors at a temperature of 350 degrees Fahrenheit at which heat it reached the the job as the distributors were well insulated. Two of the fleet of three distributors were of the insulated type and the third also had its own heating equipment.

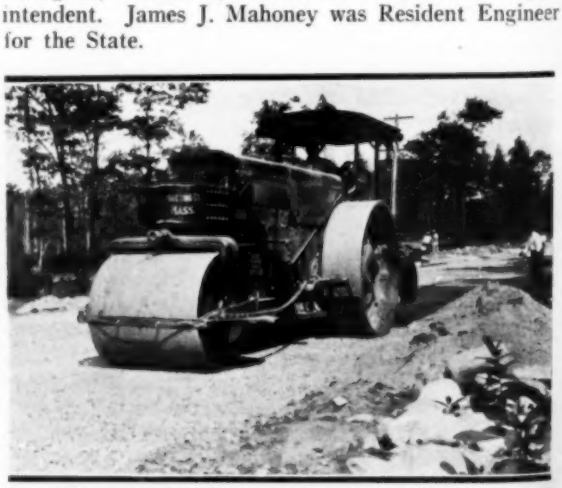
The asphalt was applied at the rate of 2¼ gallons per square yard by the distributors and immediately ¾-inch stone was hand cast to fill the top voids and rolled. The rolls of the machines were kept moist to prevent sticking by a constant stream of water on each roll from an overhead tank and perforated pipes. Later the same day or the following day the seal coat was applied by the same distributors at the rate of ½-gallon per square yard and covered lightly with hand cast ½-inch stone before rolling to complete set. A total of 64,000 tons of stone and 387,000 gallons of asphalt were used on this work.

When spreading the ¾-inch stone over the penetration two trucks and three men were used. For the ½-inch stone on the seal coat a larger number of men were used but great care was taken not to get an excess of the stone which traffic would sweep to the shoulder.

To supply the water wagon for the rollers and direct the shovels working nearby a Barnes triplex pump with Hercules power was used, developing about 100 pounds pressure at the pump.

Personnel

This job which employed a total of about 135 men was handled by the Eastern Contracting Co. of Quincy, Mass., Henry A. Pompeo, President and Catherine Pellegrini, Treasurer, with Albert Allison as Superintendent. James J. Mahoney was Resident Engineer for the State.



Rolling the Base Course After the Sand Filler Had Been Hand Cast

The Editor Comments—

An Automobile Traveler's Impression of Road Conditions

As I travel about the country, my major interest is the construction projects which I am visiting. When I drive over a concrete road and can feel every expansion and contraction joint I mentally criticize the specifications which would permit the bumps, and the maintenance crew for not removing them. Considering each state in which I drove early in the summer of 1932, I have recorded my general impressions of road conditions.

Mississippi—The state where they hoodwink the headlights and insure the windshield because of the predominance of loose gravel roads. They do build good concrete roads—when they build them.

Tennessee—A fine example of a well-conceived road building program. Good concrete roads and fine black top on concrete base.

Kentucky—Few good roads.

West Virginia—Plenty of excellent asphalt roads with a generous amount of concrete. A state which in the last five years has risen from third rate to first class as regards its highway system.

Virginia—First class with an increasing number of well-built asphalt roads and with well-maintained top soil or gravel roads.

Louisiana—Some very good concrete, but too much dusty gravel.

Arkansas—Some concrete, but still too much gravel on the main roads.

Alabama—Same as Louisiana.

Georgia—Some good concrete, but any comment on this state would naturally be biased as I drove State Route 12 from Atlanta to Augusta, a dirt road, in a torrential rain and with a long detour—but didn't slide off the road.

South Carolina—Increasing number of first class concrete highways.

North Carolina—One of the first states in the south to build a first class highway system of concrete, and its top soil and gravel roads are maintained in first rate condition although they are dusty.

Lining Up the Forms

Steel road forms are an important accessory on any concrete road job. When set they must have a firm bearing so as not to spring when the oscillating finishing machine runs over them, lest the pavement have waves in it which are very noticeable to automobile drivers. Furthermore, the forms must be properly lined up and firmly staked so that there will be no lateral motion. This is always specified and is important from the aesthetic standpoint. No one would like to stand on a concrete pavement and see a wavy edge, but as far as the usefulness and strength of the pavement is concerned, it is not critically important.

Every contractor I have met on concrete road work has taken pride in lining up his forms. I met one this summer who was being so critically inspected that he was literally afraid to look at the forms. The concrete foreman was in charge of the two men who tamped and realigned the forms, and from his usual position on the shoulder between the paver and the finishing machine, he could keep a close eye on the work of these two men. But occasionally, early in the job, he would step back to the paver skip and take a look down the forms. Every time he did this the concrete inspector would follow him and immediately order him to send the men back over the forms and realign them again. Finally the contractor became a little peeved, to put it mildly, that the forms which were in perfect line should have to be gone over again and he asked the inspector why he required this, to which the reply came, "If there hadn't been something the matter with the forms you would not have come back here to look at them."

Men have been murdered for less than that!

Trouble with Cub Reporters from the Local Press

A recent news release of the Minnesota Department of Highways furnished to local newspapers warns, "When you see a crew of state engineers making surveys, it is no sign that a new highway will be built immediately, or that it will go where the stakes are set. The presence of engineers often leads to erroneous reports as to the time certain routes will be improved and the place they will be located, and such rumors have caused some communities needless worry."

The avidity with which reporters for local newspapers and Chamber of Commerce publicity men seek news around a construction job, take half truths and magnify them has caused more than one contractor considerable worry. Out in Illinois last summer, a publicity man from the local Chamber of Commerce preparing a story for the weekly newspaper was walking over a short section of concrete pavement which had been poured several days before. He asked the contractor, "When will this be opened?" The contractor answered, "In about two weeks."

You can well imagine the contractor's consternation when a news item appeared the following Saturday with a banner head to the effect that the whole of the new 12-mile concrete highway which the town had been looking forward to would be opened in two weeks.

Theodore Reed Kendall

How the Other Fellow Did It

Construction Briefs

Device for Oiling Asphalt Truck Bodies

179. It is necessary to keep the steel bodies of trucks hauling hot mix well oiled to prevent the material sticking to the body. On some jobs the superintendent requires that this be done on every trip while on other jobs, it is done on alternate or on every third trip. On a hot mix job in cnetral Ontario, the superintendent rigged up a rather novel device which was used by each truck on every third trip. The device consisted of an old oil drum with a hose attached near the bottom. The drum was set at an elevation of 5 feet above the truck bodies, giving sufficient head for a considerable spray through the flattened pipe inserted in the end of the rubber hose. The feed and shut-off were controlled solely by lowering and raising the nozzle. After spraying with the oil, the truck bodies were raised to a dumping position to allow the oil to drain out and not remain in any pools in the body to cut the asphalt of the mix. *23.2.66*

A Novel Scaffold Hanger

180. A Kansas contractor recently developed a scaffold hanger made of ½ x 2-inch iron, as shown in the illustration. A hook was turned on the end. Holes were drilled at intervals for different sized beams, and a shackle made of ¼ x 1¾-inch iron forged round in the middle and shaped. A ⅝-inch bolt was used. These hangers can be moved from one location to another, without changing the scaffold line, by simply unhooking. This is a convenient tool that can be made in any shop.

The Scaffold Hanger

Rubber Shoes for One-Man Graders Prevent Slipping

181. One-man graders are built with both rubber tires and with crawler traction. While crawler traction works admirably in blading trap rock on a penetration macadam job, rubber tires would soon be ruined. A New England contractor was faced with just this problem when he substituted two one-man power graders for spreader boxes in spreading 2½-inch trap rock. On one of the superelevated curves with a 100-foot radius the one-man graders could not operate satisfactorily as the front steel wheels, having no traction, simply slid over the stone and the machine could not be steered. The operator of the grader on this job showed ingenuity in applying old motor truck tires to the front wheels, wiring them on with immediate beneficial results. The graders steered as satisfactorily as though they had the rimmed wheels which are provided for grading on dirt roads but which could not be used on this job as the graders were called upon frequently to run over the completed road and the rims would have cut up the surface badly. *22.2.61*

Ventilating Tunnels

182. There still seems to be considerable diversity of opinion as to the best way to ventilate rock tunnels immediately after blasting. Some contractors prefer to blow air into the face to clear the smoke and fumes from that section so that mucking can be started immediately. This is the method used recently on the new water tunnel in Baltimore. Other superintendents feel that it is better to use a suction line and pull out the fumes from the heading, permitting fresh air to come in through the tunnel itself. This latter method necessitates a tighter ventilating line in order to secure effective service than does the first but it has one very distinct advantage, namely, that the entire tunnel is freed of gases in the quickest possible time. In the first instance, the gases are blown back from the heading and cause considerable discomfort to all employees working in the tunnel between the heading and the next shaft.

A contractor operating in West Orange, N. J., used the suction type of ventilation and experienced an interesting difficulty, which he overcame satisfactorily. Because of the high suction in the 8-inch vent pipe, stones which were thrown into the pipe by the blast were in many instances sucked the entire length of the pipe and caused trouble at the blower. These stones also battered the end of the pipe, causing additional friction and a reduction in cross suction which decreased the effectiveness of the ventilating system. To obviate this, a metal cone of ¼-inch material was welded with prongs which slip inside the pipe to hold the cone in place. The cone deflected rock from the blast and effected considerable saving in operation as it minimized the shut-downs. *23.2.73*

Easily Pulled Stakes

183. Where a 4-inch poured expansion joint is used in a concrete pavement or concrete base for asphalt pavement, an expansion board or box form made of wood is usually used in the slab and staked with four stakes on the side near the paver. A similar set-up is used on headers or bulkheads for construction joints. It is sometimes difficult to pull stakes of this kind but one Illinois contractor has developed a scheme which works most successfully. He makes the steel stakes with lugs about 2 inches from the top and at a height so that they are above the concrete when the slab is poured on the second side. The lugs are used in pulling the stakes. A mattock or pick is placed under the lug, using the expansion board or header as a fulcrum and the pins are pulled without any delay. *23.3.50*

Tank Level Indicator Used on Aggregate Bins

184. The familiar indicator seen on railroad water tanks, showing how many feet of water there are within the tank, was adopted by a Canadian contractor upon the suggestion of the inspector to show approximately the amount of aggregate in the hot bins of a 2,500-yard asphalt plant. It is a well-known fact that aggregate does not maintain a water level even when hot but the indicator as rigged served to show whether the bins were nearly full or nearly empty. It consisted merely of a sounding device with weights and indicators which showed quickly when one weight dropped in the bin and pulled its indicator up out of sight of the man who was feeding the material to the bucket elevator. *23.2.66*

Driving Sheeting with a Pneumatic Hammer on the Park Hill Storm Sewer

A Three-Ring Brick Storm Sewer in Denver

AN engineering job of considerable magnitude is just being completed in Denver, Colo., in the Park Hill 120-inch three-ring brick storm sewer. The Park Hill and City Park districts, two of the finest residential districts in Denver, have always been subject to flooding in times of heavy rainfall, due to inadequate facilities for running off the excess precipitation which normally occurs from two to five or six times during the summer months. The Park Hill storm sewer will relieve this situation and prevent flooding of streets, basements, and property in these districts and will carry the surface water underground to the mouth of the sewer where it empties into the Platte River. The contract was awarded to the Construction Service, Inc., and Associates, a Denver contracting firm, at a price of $1,740,293.37 and portions of the job have been sublet to other Denver contractors.

The total length of the sewer and branches is slightly over 15 miles, there being in the neighborhood of one-quarter mile of open trench, one mile of 120-inch three-ring brick, 1½ miles of 144-inch three-ring brick and nearly one mile of 108 to 102-inch three-ring brick sewer. For inside diameters of 90 inches down to 24 inches which is the smallest, the sewer is built of precast concrete pipe.

The contractors purchased one Class 360 and two Class 240 Gardner-Denver portable compressors, five 15HS sheeting hammers, three 15H paving breakers, two Model 28A spaders and two Model 128A trench diggers. In addition to this equipment, the various contractors were already equipped with a number of Gardner-Denver paving breakers and other tools as well as small portable compressors.

Most of the territory through which the sewer extends is in dry sandy soil, but in certain portions some rock was encountered. The Lawrence Construction Co., one of the subcontractors, who were placing 90-inch and 84-inch precast concrete pipe in a trench 26 feet deep, encountered a bed of sandstone varying in thickness from 3 to 12 feet. When this was first met, it was presumed that blasting would have to be resorted to, but this was not necessary as they were able to break out the sandstone with Model 15H paving breakers and 5-inch chisels. Most of the time they used three breakers and one sheeting hammer at the same time, with a G-D portable compressor supplying the air for all four machines. This work is a very severe strain on the paving breakers and the four machines kept the compressor operating at capacity in the mile-high altitude of Denver.

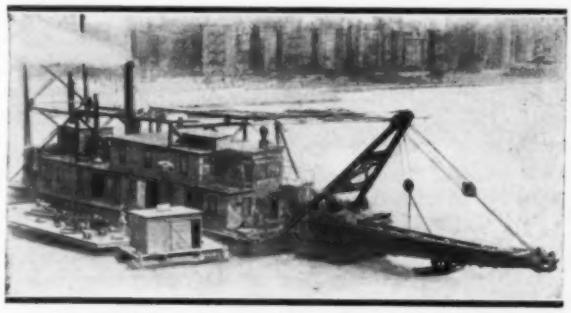
Virtually all of the sewer was constructed by the "open-cut and back-fill" method, but at one point it was necessary to construct a tunnel some 300 feet in length under the switch yards of the Union Pacific Railway to carry the 120-inch sewer. This portion of the job entailed some particularly fine engineering work on the part of the contractors.

A Suction Dredge with an Electric Drive

FOR some time extensive operations have been underway in the Charles River, Boston, Mass., deepening the channel and also widening the Esplanade which has been a feature of Boston's park system above the Charles River Dam for many years. The Trimount Dredging Co. has been engaged in this work with the suction dredge Middlesex. This dredge was originally operated by steam and still retains one oil burning boiler for heating purposes and for supplying a double horizontal reciprocating steam engine which operates the winding machinery. The cutter head and the dredge pump, however, are now operated by electric motors, using outside current.

The dredge pump has a 17-inch suction and a 15-inch discharge and requires a 500-horsepower variable speed motor of 500-rpm maximum speed. For the cutter head which runs at a maximum speed of 25 rpm, a 300-horsepower variable speed motor of 1,750-rpm maximum speed is used, necessitating speed reducers between the motor shaft and the main shaft upon which the cutter head is mounted. The reduction is made in two steps, the first being accomplished by a De Laval worm gear of 13¼ to 1 ratio. As the ladder is operated at various angles from the horizontal up to an inclination of 45 degrees, a forced feed lubricating system is employed, consisting of a gear pump at one end of the worm shaft, connected to draw oil from the bottom of the case and deliver it to each of the plain sleeve bearings of the worm gear shafts and to the worm and gear tooth surfaces, as well as to a Kingsbury bearing which takes the thrust of the worm. The gear shaft carries a pinion which engages with a cast steel, cut tooth, spur gear enclosed in a water-tight casing and running in oil.

The bedplate supporting the motor, the worm drive and the bearing stands, both fore and aft of the spur gears, is of welded construction and is slipped between, and riveted and welded to, the side girders of the ladder. The ladder, with the cutter machinery, measures 60 feet 8 inches from the hinge pin to the end of the cutter. It replaces one of much lighter construction and is partly supported when in the water by a pontoon tank measuring 17 feet 6 inches by 14 feet by 6 feet deep which is secured to the under side of the ladder hinges and stands with its top appproximately at water level when the cutter machinery is in a horizontal position. The joint between the ladder suction pipe and the hull pipe is a water-serviced swivel elbow. The hull of the dredge itself it of wood and measures 106 feet long by 35½ feet beam by 10 feet deep. The dredging machinery of the Middlesex, including the dredge pump assembly, the winding machinery, the A frame, all sheaves and the cutter machinery, was designed and built by the Norbom Engineering Co., Darby, Pa.



The Suction Dredge Middlesex, of the Trimount Dredging Co., in Charles River, Boston

Construction Industry News

National Paving Brick Association, Washington, D. C., will hold its Twenty-Seventh Annual Meeting at Detroit, Mich., January 17-18, 1933. The Association is one of the organizations participating in the Highway and Building Congress which will meet in Detroit during the same week. It will exhibit at the Annual Road Show in the Municipal Airport Building and will hold its Annual Meeting at the Book-Cadillac Hotel in Detroit. The sessions on January 18 will be open to the general public.

Jeffrey Manufacturing Co., Columbus, Ohio, has announced the removal of its southwestern branch office from Houston to Dallas, Texas. T. P. Burke will continue as manager.

The Allied Construction Equipment Co., a new company, with headquarters at 1900 No. Ninth St., St. Louis, Mo., has recently been announced. The personnel of this new company is made up of Gilbert F. Knierim and Edw. P. Rausch, formerly with The Geo. F. Smith Co., and H. B. Owsley, formerly head of the Lakewood Equipment Co. At present this company represents the following manufacturers: The Jaeger Machine Co., Lakewood Engineering Co., General Excavator Co., Ohio Power Shovel Co., Moritz-Bennett Corp., J. S. Mundy Hoisting Engine Co., The Hercules Co., Beaumont Mfg. Co., A. Leschen & Sons Rope Co., Skelton Shovel Co., Bates Wire Tie Co., Vulcan Iron Works, Universal Form Clamp Co., Boston Woven Hose & Rubber Co., Winslow Government Standard Scale Works, Sasgen Derrick Co., Jones Superior Machine Co., and Worthington Pump & Machinery Co.

Jenison Machinery Co., San Francisco, Calif., has recently moved to its new location at 20th and Tennessee Sts., as part of the plan laid out in 1928 to centralize its operations at one point in its own building. The layout is unique for an equipment distributor's plant.

Giles & Ransome, Philadelphia, Penna., has announced its removal to larger quarters at 17th Street and Sedgely Avenue, Philadelphia. In addition to the lines formerly carried, this company has recently taken on the agency for Caterpillar tractors and allied lines.

Drilling and Blasting in Highway Grading

(*Continued from page 32*)

AMOUNT OF DRILLING PER CUBIC YARD OF PAY MATERIAL

2-foot cut	14.25 linear feet
4-foot cut	3.56 linear feet
8-foot cut	0.89 linear feet
16-foot cut	0.22 linear feet

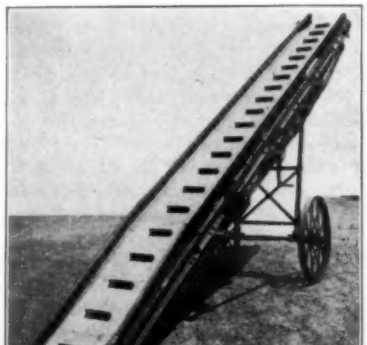
Thus, if the cost of drilling be 30 cents per linear foot, as is frequently the case, then the cost of drilling alone is $1.07 per cubic yard of pay material for the 4-foot cut, 27 cents for the 8-foot cut, 7 cents for the 16-foot cut and the entirely prohibitive figure of $4.275 for the 2-foot cut. Even in the case of the 4-foot cut, the cost of the drilling alone is higher than the price frequently bid for moving solid rock while on the other hand in the case of the 16-foot cut the unit drilling cost becomes but a relatively small item in the total cost of moving the material.

A New Heavy-Duty Elevating Grader

A NEW heavy-duty elevating grader, known as Elevating Grader No. 11, which has a new frame, front axle and plow beam design, a 48-inch carrier with both the carrier and plow controls power-operated, has been announced by the J. D. Adams Co., Indianapolis, Ind.

The new frame and front axle construction eliminates the usual fifth wheel, and provides stability and balance to handle the long wide carrier for which this machine is designed. The plow beam takes draft directly at the tongue connection on the front axle. The new 48-inch carrier is equipped with shaft and gear drive, has ball bearings throughout, and provides greater carrying capacity. This carrier is available in 19, 22 and 25-foot lengths. The operator, from his position at the plow, has immediate control of the upper carrier, center of carrier, lower carrier and plow, all of which are raised and lowered by power through enclosed gears.

Power for operating the carrier and the controls is supplied by an auxiliary engine or tractor power take-off as desired. The auxiliary engine drive uses a new improved McCormick-Deering power unit.

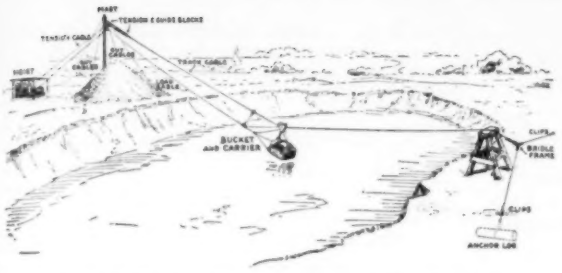


The New Link-Belt Portable Belt Conveyor

A New Cleated Portable Belt Conveyor

A NEW portable belt conveyor with improvements such as fixed steel retaining sides extending the entire length of the conveyor, preventing material from spilling over the sides of the belt at any point, has been announced by the Link-Belt Co., Philadelphia, Pa. To obviate a common source of trouble experienced with portable belt conveyors of this general type, the foot end has been improved to keep material away from the return run of the conveyor belt. A new arrangement of the foot end plate also permits the convenient use of the machine without this plate, when desired, to minimize labor in feeding and serving to speed up loading.

The belt is 21 feet long on centers and 18 or 24 inches wide, with all-metal troughing-type rollers with anti-friction bearings. The head pulley is 9 inches in diameter and the discharge height is regulated through a spur-geared hand crank by winding a cable on or off a drum. A steel pawl holds the conveyor in position. The conveyor has a sharp pointed foot which makes it easy to push the conveyor into a pile. The machine is mounted on wide-tread, large-diameter truck wheels fitted with roller bearings.



A Typical Set-Up of the Utility Slackline Cableway for Digging Pit-Run Gravel

A New Line of Drag Scraper and Slackline Cableway Machines

A NEW series of drag scraper and slackline cableway machines, known as the Sauerman Utility line, has recently been announced by Sauerman Bros., 464 So. Clinton St., Chicago, Ill. These machines are being made in a number of popular sizes for handling the average type of contracting work. The cableway excavators are offered with four different sizes of buckets, of 9, 13, 20 and 26-cubic foot capacity, and with operating spans of 300, 400 and 500 feet. The machines are divided into three series, gasoline-driven, electric-driven and belt-driven.

Among the features of the bucket are a structural steel bail and welded back, and a renewable reinforced bottom. The carrier is equipped with alloy steel track sheaves. The mast-blocks are the Durolite steel blocks. The power units are of rugged construction with semi-steel drums of large diameter, semi-steel side stands, steel gears provided with ball bearings and steel shafts. The hoists are mounted on rolled steel bed frames of one-piece box construction.

The drag scraper machine comes in five models of gasoline-driven machines and a like number of electric-driven and belt-driven units. The buckets used are the Sauerman Crescent models of 9, 13, 20, 26 and 40-cubic foot capacities.

A 2-Inch Centrifugal Pump

A NEW 2-inch self-priming centrifugal pump, designed on the same lines as the larger Marlo self-primers, has been announced by Marlow Pumps, Ridgewood, N. J. This new pump weighs 110 pounds, has a capacity up to 80 gpm, suction lifts up to 25 feet and total suction and discharge up to 30 feet.

The pump has an open impeller of bronze, only one moving part in the automatic priming control arrangement with the principal pump castings made of aluminum. There are nine rings of packing on the gland, with the take-up device moving ½-inch along the shaft. The engine is 4-cycle, having a removable cylinder head and is equipped with both foot and rope starter. The engine crankshaft has Timken roller bearings, is heat-treated and counterbalanced, and equipped with an Eisemann magneto, air cleaner, and speed changer to permit the engine speed to be varied to meet the needs of the job.

Improved Draglines and Buckets

LEVEE construction, road building and excavating projects have made the use of draglines an important factor in turning out large volumes of work at low cost. Harnischfeger Sales Corp., Milwaukee, Wis., has recently announced improvements in its line of P & H dragline buckets. Made in sizes from ⅝ to 4-cubic yard capacity, these buckets are of combination riveted and welded construction, giving ample strength with minimum weight. The shell of the bucket is welded together, eliminating projecting rivet heads and permitting the bucket to scour easily. The dump sheave is simple and trouble free, the cable can not slip off, the sheave requires infrequent attention because of its self-oiling bearing and the spreader bar is made of angle iron riveted into a box section with white oak filler, making it resistant to end compression.

The bucket shell is built of heavy tank steel, with the bottom and sides cut from a single piece and the back welded into position. Four forged renewable wearing shoes are welded to the bottom of the bucket. The cutting lip, which is readily renewable, is a heavy piece of forged boiler plate extending well up the sides of the bucket and securely fastened with countersunk rivets. The bucket teeth are special manganese steel castings, riveted through the lip and bottom of the shell, and the teeth points are renewable and reversible.

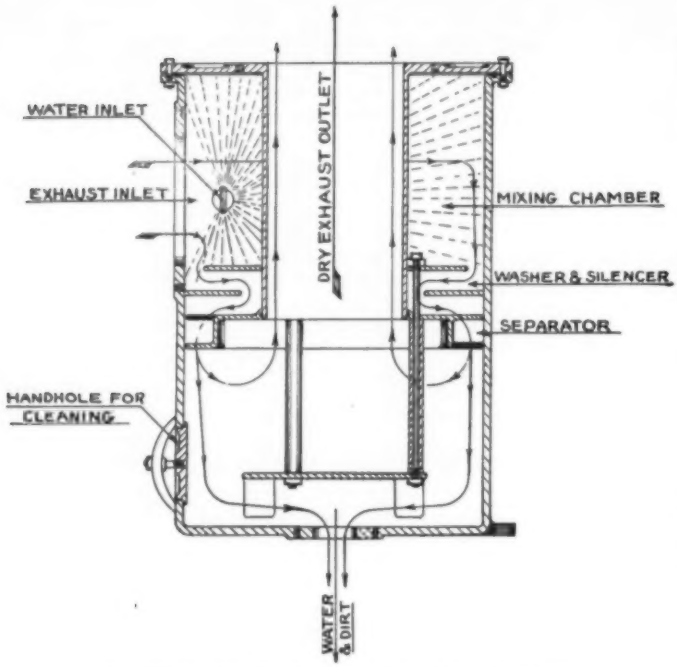
An Elevator and Scoop for Bulk Cement

A NEW method of handling bulk cement for which reduced handling costs are claimed has been announced by Sprout, Waldron & Co., Inc., Muncy, Pa. A complete unit consists of a combination of horizontal and vertical screws, with anti-friction bearings sealed against dust. The horizontal screw extends under the tracks so that it will unload cement from hopper or box cars of all types. There is a special chute which may be rigged for handling the cement from box cars to the horizontal screw which delivers the bulk cement to a concrete box from which it is lifted by the vertical helicoid type conveyor which is self-supporting, being attached to the bin at the top of the storage bin.

The gears are of cut steel and run in oil. Roller chain drives are used throughout and the drives are taken from one power source, which may be either a gas engine or motor. The vertical screw elevators are painted with a high grade aluminum paint to insure them against exterior corrosion.

A power shovel for use in unloading bulk cement from box cars is also manufactured by this company. This Monarch Clark shovel consists of a two handle steel scoop attached to one end of a wire rope which leads over suitably arranged sheaves, and whose end is attached to the drum of an automatic winch. The operator pulls the scoop to the desired position, plunges it into the material and slackens the rope. This automatically causes the weights to reverse the drum, trip the catch and throw the clutch into gear. The scoop is then drawn to the point for discharging the load. It is usually mounted on the bin structure and driven from the power plant driving the vertical screw or bucket elevator but may be furnished with a direct connected motor.

A Sprout-Waldron Vertical Screw Elevator Outfit Complete with Power Shovel for Unloading from Standard Box Cars



The Model EW Maxim Exhaust Washer and Silencer

A New Silencer for Diesel Engines

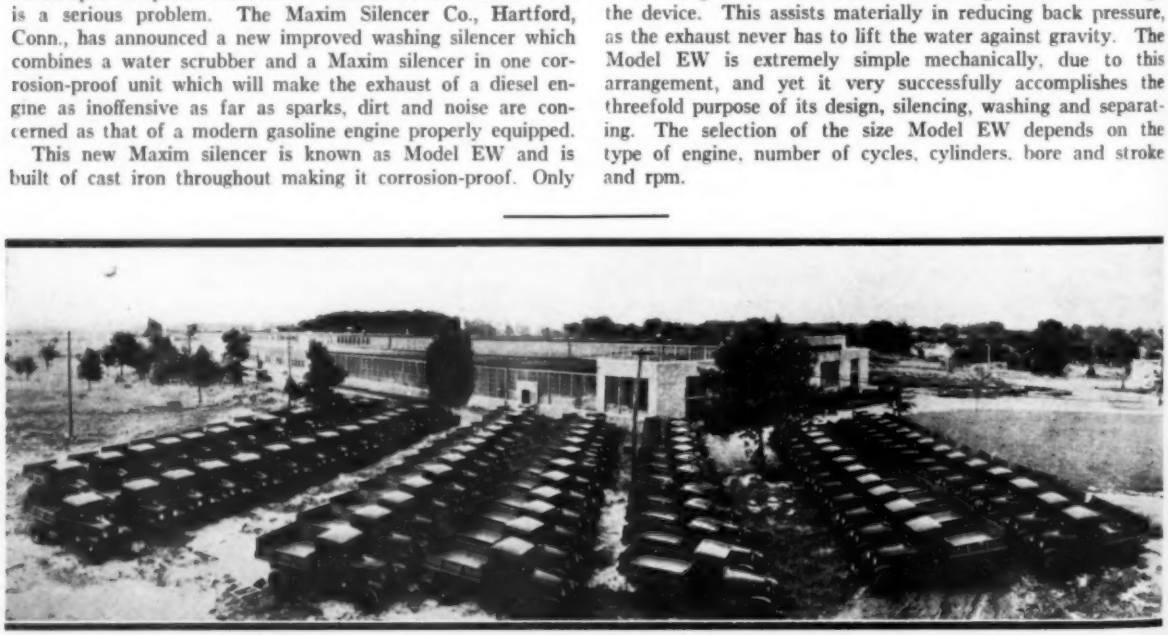
DIESEL engines are being used in increasing numbers on heavy pieces of construction machinery notably draglines, shovels and cranes. In common with gasoline engines they have a noisy exhaust. When these machines are called upon to operate close to or within cities the exhaust noise is a serious problem. The Maxim Silencer Co., Hartford, Conn., has announced a new improved washing silencer which combines a water scrubber and a Maxim silencer in one corrosion-proof unit which will make the exhaust of a diesel engine as inoffensive as far as sparks, dirt and noise are concerned as that of a modern gasoline engine properly equipped.

This new Maxim silencer is known as Model EW and is built of cast iron throughout making it corrosion-proof. Only a moderate amount of water is required as the cooling circulation is sufficient. It is smaller and lighter, size for size, than the standard dry type Maxim silencer. It will quench all sparks, wash the exhaust clean of all carbon and dirt, and quiet the exhaust just as much as the standard dry-type Maxim exhaust silencers.

The exhaust inlet is on the side of the pot near the top. The inlet for the washing water is adjacent to the exhaust inlet, a little to one side. The dry, clean exhaust outlet is at the center of the top head, or cover plate. The drain from the water and the dirt is at the center of the pot bottom. There is a very large hand hole in the side of the pot near the bottom for cleaning out the accumulated dirt and carbon from the separating chamber. Feet are cast on the side of the pot at the bottom, so that the silencer may be bolted down to the deck of a vessel, crane, shovel or dragline or to any stationary foundation.

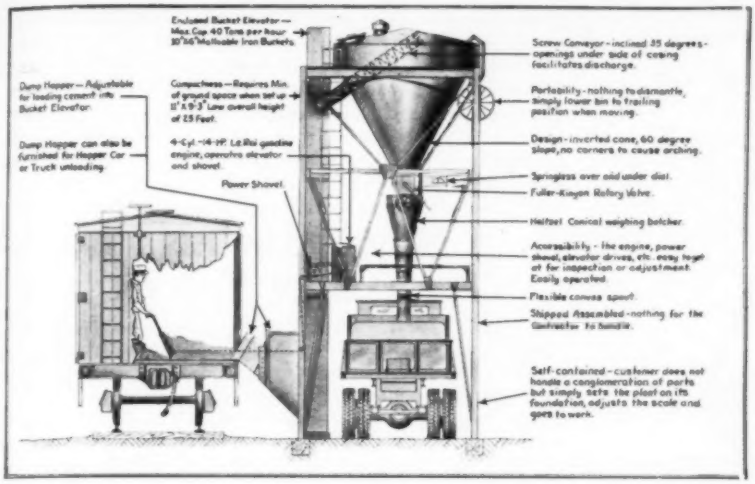
The engine exhaust pipe is attached to the side inlet, near the top. The water is sprayed across the incoming exhaust stream, inside the device, just after it enters. The water and the exhaust gases then travel down through the combination silencer and washer. This part of the Model EW is actually the same acoustically as the standard Model M2 wet type Maxim silencer, except that it is mechanically altered so that it is in vertical form rather than in the customary horizontal form. The last plate in this silencer section has a number of blades, properly proportioned and designed to give the mixture of gases and water a violent whirl around the inside surface of the separating pot, which is at the bottom of the whole device. This separates the water, with its entrained dirt, from the gases. The gases then move to the center of the device and go up the central standpipe, and out. The water and dirt move to the bottom and go out the large drain.

The entire process of washing and silencing is performed while the gases and the water are moving downward through the device. This assists materially in reducing back pressure, as the exhaust never has to lift the water against gravity. The Model EW is extremely simple mechanically, due to this arrangement, and yet it very successfully accomplishes the threefold purpose of its design, silencing, washing and separating. The selection of the size Model EW depends on the type of engine, number of cycles, cylinders, bore and stroke and rpm.



A FLEET OF 100 HERCULES DUMP BODY TRUCKS RECENTLY DELIVERED TO THE HIGHWAY DEPARTMENT OF THE COMMONWEALTH OF PENNSYLVANIA

This fleet of 100 large trucks equipped with Model 252 Hercules heavy-duty tubeless hydraulic hoists and 1½-cubic yard capacity all-steel braced side Hercules dump bodies is one of the largest fleet of dump trucks which has been sold on a single order


Enclosed Bucket Elevator — Max. Cap. 40 Tons per hour — 20"x6" Malleable Iron Buckets.
Dump Hopper — Adjustable for loading cement into Bucket Elevator.
Compactness — Requires Min. of ground space when set up — 11' 4.9-3" Low overall height of 23 Feet.
Dump Hopper can also be furnished for Hopper Car or Truck unloading.
4-Cyl. 4½" x 9" Lt. Wt. gasoline engine, operates elevator and shovel.
Power Shovel.
Screw Conveyor — inclined 35 degrees — openings under side of casing facilitates discharge.
Portability — nothing to dismantle, simply lower bin to trailing position when moving.
Design — inverted cone, 60 degree slope, no corners to cause arching.
Springless over and under dial.
Fuller-Kinyon Rotary Valve.
Heltzel Conical weighing batcher.
Accessibility — the engine, power shovel, elevator drives, etc. easy to get at for inspection or adjustment. Easily operated.
Flexible canvas spout.
Shipped Assembled — nothing for the Contractor to handle.
Self-contained — customer does not handle a conglomeration of parts but simply sets the plant on its foundation, adjusts the scale and goes to work.

The New Heltzel Portable Self-Contained Bulk Cement Batching Plant with Enclosed Bucket Elevators and Screw Conveyor for Raising the Cement

A Portable Self-Contained Bulk Cement Batching Plant

A SELF-CONTAINED plant for unloading and batching bulk cement with unloading equipment adaptable to box, hopper or tank cars and trucks has been announced by the Heltzel Steel Form & Iron Co., Warren, Ohio. An automatic power shovel is used to unload cement from box cars into the elevator hopper, which is adjustable to varying car door heights. When trucks are used a larger dump hopper is furnished and the automatic power shovel is omitted. When unloading hopper or tank cars, a horizontal screw conveyor is used in place of the elevator and power shovel.

The elevating equipment consists of an enclosed bucket elevator feeding into an inclined screw conveyor. The under side of the conveyor is provided with openings which permit it to discharge cement at the first available opening rather than carrying it to the top of the inverted cone hopper before discharging it. The cement bin is an inverted cone with slopes of better than 60 degrees to prevent arching of the cement. The flow of cement from the bin into the weighing hopper is controlled by a dust-proof cement valve. The batching plant may be equipped with conical weighing batchers of various capacities, suspended on a single beam cement scale equipped with a springless over and under dial or on a 24-inch diameter full graduated springless, automatic dial scale. A flexible spout fastened to the underside of the batch hopper is used for loading batch trucks.

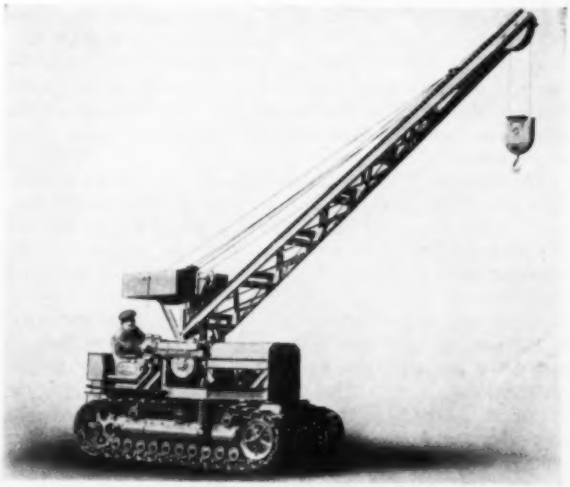
All controls are conveniently located on the operator's platform. The driving motor, power shovel, drives and inspection doors are conveniently located for inspection. Continuing the Heltzel trailer system, the plant may be furnished with or without trailer wheels. When trailer wheels are furnished, the bin may be lowered to the trailing position, attached to the rear of a truck and moved to a new location. When trailer wheels are not furnished, the plant may be placed on a highway trailer or flat car. In either instance the elevator and other accessories are moved as a unit with the bin.

A Full-Revolving Hydraulic Crane

A FULL-REVOLVING crane mounted on the Cletrac 35, a unit which is easily maneuvered, is mobile and has positive traction enabling it to pick up heavy loads and move them quickly where desired, regardless of ground conditions, has been announced by the Cleveland Tractor Co., 19321 Euclid Ave., Cleveland, Ohio.

The tractor has twenty lower track wheels which permit the handling of heavy loads without overloading the track wheels. These wheels support the entire track from front to rear and permit driving the unit over uneven ground or obstructions. The counterbalance revolves with the turntable, which keeps it opposite the lift at all times. The turntable is revolved by a 6-cylinder hydraulic radial motor located at the left-hand corner of the turntable cover. Another identical motor is mounted on the right-hand corner of the turntable, operating the drum for raising and lowering the cable. Pressure is supplied for operating the hydraulic motors by a radial 6-cylinder pump mounted on the rear of the transmission case and driven by the power take-off of the tractor. Raising and lowering of the cable are governed by the movement of a single control which opens and closes a control valve. A similar control regulates the revolving of the boom, which is handled by the operator from his seat.

The heavy welded frame is mounted on the Cletrac by fastening the front end of the ⅜-inch steel boiler plate radiator shield to the tractor motor frame, thus carrying a portion of the load on the heavy duty equipment mounting spring, with which the tractor is equipped. The outside support comes on the equipment mounting trunnion on large coil springs. The width overall of this unit is 87 inches, its height, 108 inches and its length, 145 inches. The boom lengths are 15, 18, 21 feet or as desired with a boom reach of 20 feet in any direction.



The New Cletrac Full-Revolving Crane

The New Williams Champion Bucket

A New Clamshell Bucket

THE new Williams Champion clamshell bucket, recently announced by the Wellman Engineering Co., 7012 Central Ave., Cleveland, Ohio, is made in a number of capacities to meet the various requirements of contractors for excavating and rehandling work. Among the features of this new bucket are the tandem arrangement of the power arm sheaves giving a straight-line closing pull, conserving the power for digging; the steel corner brackets extending well beyond the backs of the scoops; the use of cast steel and rolled steel parts to cut down the head width, giving more rigidity and strength; and a broad, more solid bearing surface for the return sheave pin to prevent weaving or wobbling, even after long service. A one-piece full-width main hinge keeps the scoops in alignment and Alemite industrial type fittings are found at every point where lubrication is needed.

A Three Unit Bituminous Paver and Finisher

THE bituminous paver and finisher announced by Barber-Greene Co., 485 W. Park Avenue, Aurora, Ill., some time ago is now being manufactured as a three unit machine, thus increasing its utility. What was previously the paver is now two units consisting of a special loader as the first unit and the mixer as a second unit. The finisher is practically the same as before with the exception of some minor improvements.

The loader is of large capacity and may be used for grading, light excavating, loading excess dirt that must be hauled away, stock piling and reclaiming. The loader may be run through the windrowed stone for aerifying, drying and replacing in the windrow ready for processing when the loader is returned to the mixer. This method is considered superior to blading the windrow back and forth because it is thorough, clean and rapid.

The new design of the loader used with the mixer includes two 400-gallon tanks for carrying a supply of oil or asphalt on the loader itself. The mixing unit when used with the loader is attached by means of a king pin and trails on its own wheels or Athey wheels, being towed by the loader. This unit is equipped with an 82-horsepower plant and has a positive feed pump driven through the same countershaft as the apron feeder which measures out the aggregate. The pump takes the oil or asphalt from the supply tanks on the loader and delivers it to the spray nozzles in the spray chamber. This connection is through flexible hose and piping but has no relation to the pump on the loader. The power plant also drives the double pug mill and has ample capacity to insure operation in fine aggregate, heavy materials, and at high altitudes. The finisher is practically the same unit as was described in the original announcement.

A New Tubeless Tire for Wheel Tractors

A NEW tubeless tire having great tractive ability as well as a cushioning effect has recently been announced by the B. F. Goodrich Co., Akron, Ohio, for road construction and maintenance equipment.

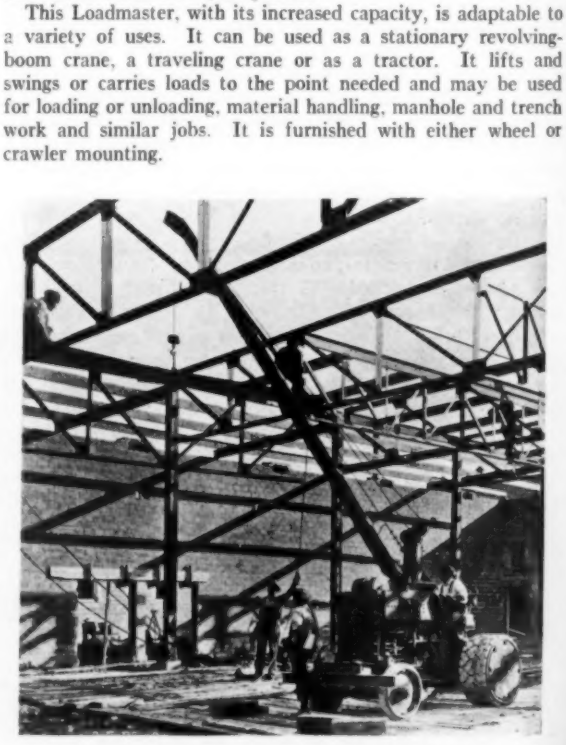
This new Zero Pressure tire consists of a rubber arch built on a slotted steel base for application to solid tire wheels. The piers of the arch are of sufficient size and rigidity to provide ample load capacity. The all-rubber arch is flexible to give full tread contact. As the tire is not under air pressure, no penetrating obstacle can cause damage or delay.

These tires are made in a complete line of sizes for all wheel tractors and, according to the manufacturer, they have already been adopted by many state highway departments for their road building and maintenance equipment.

An Improved Crane Unit with Choice of Power

ANNOUNCEMENT has been made that the Loadmaster crane, manufactured by the Bucyrus-Erie Co., South Milwaukee, Wis., is now available with either Case or McCormick-Deering power and that the capacity of the crane has been increased to 4,500 pounds.

This Loadmaster, with its increased capacity, is adaptable to a variety of uses. It can be used as a stationary revolving-boom crane, a traveling crane or as a tractor. It lifts and swings or carries loads to the point needed and may be used for loading or unloading, material handling, manhole and trench work and similar jobs. It is furnished with either wheel or crawler mounting.



The Bucyrus-Erie Loadmaster Crane

A Readily Portable Gravel Plant

A TRAILER-mounted crusher screening plant which is a complete unit within itself and which can move along with the shovel as it works its way into the face or bank of gravel has been developed by the Pioneer Gravel Equipment Mfg. Co., 1515 Central Ave., N.E., Minneapolis, Minn. The plant is complete with screen crusher and power unit all mounted on the same trailer equipped with rubber tired wheels.

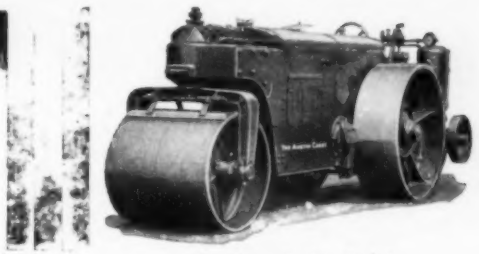
The materials are loaded into the 2½-yard hopper by a shovel or boom dragline and are fed to the screen by a plate type mechanical feeder. Materials not passing the perforations of the screen are delivered to the jaw crusher for primary breaking and then to the roll crusher from the bucket elevator for the secondary breaking before returning to the screen. This provides over 75 per cent additional crushing capacity over a single crusher plant.

The Pioneer Duplex Trailer Plant

The Pioneer Duplex trailer plant is 25 feet long overall and has a 14-foot 4-inch wheelbase; the main frame is built of 10-inch channels and truss braced; the shaker screen measures 30 x 120 inches; it is equipped with an 8 x 36-inch jaw crusher; a 14 x 24 or 18 x 24-inch roll crusher; and a 100-horsepower motor with a 10-inch endless belt power drive. The feeding hopper is 6 x 6 feet and the delivery conveyor 24 inches x 20 feet with a 20-foot bucket elevator with 14 x 6-inch buckets. The weight of the plant complete is 46,000 pounds.

A New Model of a Well Known Roller

THE Austin-Western Road Machinery Co., 400 No. Michigan Ave., Chicago, Ill., has announced a new model of the Austin Cadet roller, patterned more closely than ever after the Austin double spur gear drive Autocrat roller. The new Austin Cadet is made in 5, 6, 7 and 8-ton sizes, steers more easily, has a full differential action which equalizes the power on the rear rolls whether it is operating on a sharp curve or on a straight-of-way, has automatic shifting of weight on the front roll which concentrates the pressure on high spots where it is needed, and has the well-known double-spur gear drive. This new model has a lower center of gravity, unusual fuel and lubrication economy, an unusually large air tank capacity, is balanced scientifically to minimize pitching and side swaying and has speeds adaptable for all work. Its high built, full length side plates provide stronger construction. Its specially built transmission and differential are tested for eight hours under load before shipping. It has disc clutches which can be adjusted and replaced easily. It has sufficient power for climbing steep grades as long as the rear wheels have traction. The water-cooled air compressor does not stop when the motor is idling. The gears are shifted as easily as on a truck with one clutch lever controlling all forward and reverse motion. In the construction of the roller there is generous use of anti-friction bearings. It is built with a short wheel base for easy maneuverability, is equipped with a powerful scarifier and is so built as to be easily accessible and conveniently arranged for making adjustments and repairs.



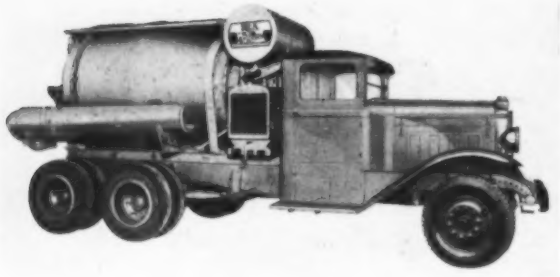
The New Austin Cadet Roller

A 240-Foot 4-Cylinder Portable Compressor

ONE of the features of the 240-foot 4-cylinder V-type portable compressor recently announced by the Curtis Pneumatic Machinery Co., 1671 Kienlen Ave., St. Louis, Mo., is the carbon free valves. According to the manufacturer, the major factors in arriving at this result are the delivery of the air into the cylinder at the lowest possible temperatures and the maintenance of the piston and cylinder walls at a minimum temperature. The low temperature of the air taken into the cylinder is secured by making large diameter short intake passages, large ports and straight line air flow. The compressor intake and air cleaner is located outside and above the hood. Minimum cylinder and piston wall temperatures result from exceptionally large water jackets and the design for the cooling of the cylinder head surfaces adjacent to the cylinder walls, the cooling water coming in contact only with the head portions that actually require cooling. These combined with the centralized flow discharge valve ports and ample head volume result in a low peak pressure and temperature of compressions so that there is practically no vaporization of the lubricating oil on the cylinder and piston walls.

Other features of this unit are its large capacity, Timken roller main bearings, adjustment for wear without opening the crankcase and easy starting in cold weather. These outfits may also be secured in the 180-foot, 4-cylinder size, and in 40, 66, 80 and 120-foot sizes with 2-cylinder compressors. All of the units are furnished either portable or with skid mounting.

The New Curtis Carbon-Free Heavy-Duty Compressor



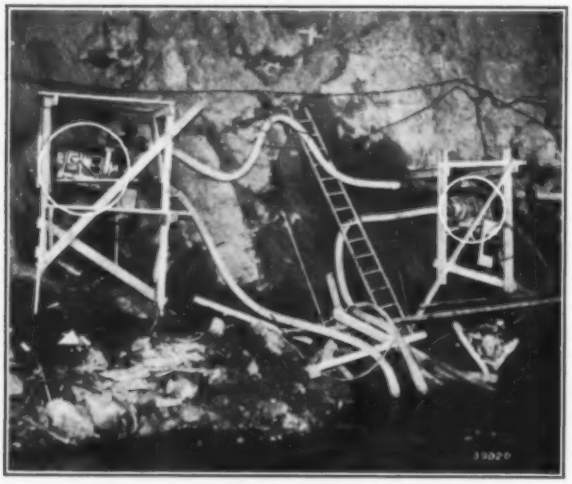
The New Rex Moto-Mixer

A New Truck Mixer and Agitator

A NEW Rex Moto-Mixer which handles 5 yards of mixed concrete or 7 yards as an agitator has been announced by the Chain Belt Co., 1666 West Bruce St., Milwaukee, Wis. The drum has three-point suspension with the forward end riding on a single SKF ball bearing and the rear end on two Timken equipped rollers. The conical front section of the drum is combined with large impellers for thorough mixing. The discharge is controlled through a hand wheel and worm and gear reducing unit. It is equipped with a one-man spout, the end of the spout nearest the discharge being mounted on a double hinge. When the truck is traveling, the spout rides in a cradle beside the drum, replacing one fender. This new Moto-Mixer can also be equipped with a Rex-Heil Jackass hoist. The water system is a calibrated overflow pipe in which the pipe is set to the desired quantity. All water above that amount overflows, preventing all danger of over wetting the batch. The water tank carries a second compartment for washout water. Both mixer and agitator units are driven by independent motors equipped with electric starters run from the truck battery. All controls are located at the rear of the machine to facilitate discharging.

An All-Round Centrifugal Pump

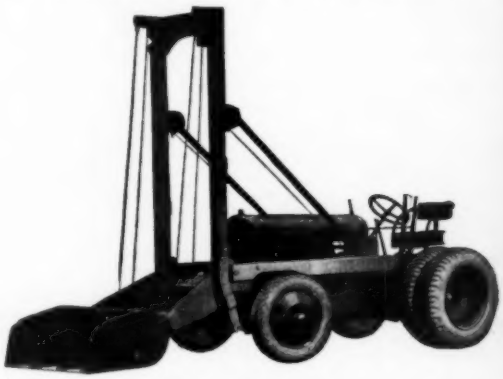
A PUMP made in capacities from 5 to 800 gallons per minute for heads up to 100 feet and from ¼ to 25-horsepower sizes with open type, totally enclosed or explosion-proof motors has been announced by the Ingersoll-Rand Co., 11 Broadway, New York City, in the Cameron Motorpump. The unit is built with dust-proof ball bearing construction and with a one-piece bronze enclosed hydraulically balanced impeller mounted on the motor shaft extension. It has a deep stuffing box with a water sealed passage and needle valve control. All parts are mounted on one large diameter, heat-treated steel shaft insuring rigidity and maintaining rotor alignment. The motor has a solid rotor and squirrel cage bars, end rings and fan blades which are cast as one unit and with no joints. The suction nozzle leads straight into the impeller eye, its removal giving complete access to the impeller and interior of the pump casing. Both suction and discharge nozzles of the pump casings are flanged with equally spaced studs permitting the discharge nozzle to be set in four positions.



The Cameron Centrifugal Motorpump

A High-Lift Tractor-Mounted Shovel

A FAST economically-operated loader for all types of dirt and material handling jobs, mounted on a McCormick-Deering industrial tractor, has been announced by the Industrial Equipment Division, Pettibone Mulliken Co., 4710 West Division St., Chicago, Ill., national sales agents for Welded Products Co., Los Angeles, Calif. The loader is light in weight and so constructed that the operator has an unobstructed view both ahead and to the rear of the tractor. One of its outstanding features is the high-lift and long-loading reach. It has a loading height of 8½ feet and can load a 2½-ton truck entirely from the rear. The loader bucket is of ½-yard capacity and has a traveling speed of 68 feet per minute. The loader can be used on a tractor equipped with either wheels or tracks.



The Fabriform Loader

The Fabriform loader is electrically welded, affording rigid construction, eliminating bolts and rivets. The lower part of the bucket track uprights are curved toward the tractor so as to assist in loading the bucket. In this operation the weight as well as the power of the tractor is utilized to fill the bucket.

A New Auto Patrol Grader

A SECOND Auto Patrol has been added to the line of the Caterpillar Tractor Co., Peoria, Ill. This new Auto Patrol No. 7 has all of the performance features of the older No. 9 machine such as three-lever power control, one for raising or lowering the left end of the blade, one for the right end of the blade and one available for either scarifier or snow plow attachment. It is a strong machine using the same frame members as the No. 9 and has weight adequate for most maintenance work. It has dual 38 x 7 lug-type Road Builder pneumatic tires in the rear and 32 x 6 truck-type tires in front.